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Grasslands earless dragon, *Tympanocryptis pinguicolla* See paper on page 22.

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THE CAPTIVE HUSBANDRY AND REPRODUCTION OF THE HOSMER' S SKINK *EGERNIA HOSMERI*

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INTRODUCTION

The genus *Egernia* is a group of 28 species of moderate to large skinks (Cogger, 1996). All are found on the Australian mainland, with one also being found in Tasmania and another in New Guinea. They are characterized by parietal shields, not in contact behind the interparietal, and a fourth toe much longer than the third (Cogger, 1996). All species are viviparous.

The Hosmer's Skink *Egernia hosmeri* is a diurnal, rock-dwelling species, found in the drier northeastern parts of Australia. It has strongly spinose dorsal and caudal scales, as do many rock dwelling *Egernia* species (Cogger, 1996; Ehmann, 1992),

Very little has been published on the captive husbandry and reproduction of this species (Banks, 1986). Adelaide Zoo has had Hosmer's Skinks in its collection since 1989, and has bred 43 in the last eight years. Our adult skinks average 149.2mm snout vent and 258.2mm total length, based on complete original tails.

This paper outlines how *E. hosmeri* is kept and bred at Adelaide Zoo and compares some of the findings with previous data.

ENCLOSURE AND FURNISHINGS

Adelaide Zoo currently has two breeding groups of Hosmer's Skinks. The exhibit group is housed in an enclosure measuring 120cm by 90cm by 130cm high. This group consists of three adults (I male, 2 females), and their young for the season. The exhibit has artificial rock walls with a sand base, rock crevices, branches, fake grass clumps and a small pond. This provides plenty of surface area, and crevices for the lizards. (Fig. 1.) The off-limit group consists of a single adult pair and their young for the season, which are housed in a 135cm. by 75cm by 60cm high wooden vivarium. This enclosure has an opening clear perspex front, and the roof is divided into two doors that allow access from the top. Two large mesh vents are also situated in the top and a row of smaller vents along the front at the bottom. A sheet of plastic protects the wooden base and is covered by a 1.5cm layer of pea gravel. Hollow logs, branches, a ceramic water bowl and several hides made of 100mm and 150mm, poly pipe, cut in half, are provided. (Fig.2.)

HUSBANDRY

Feeding

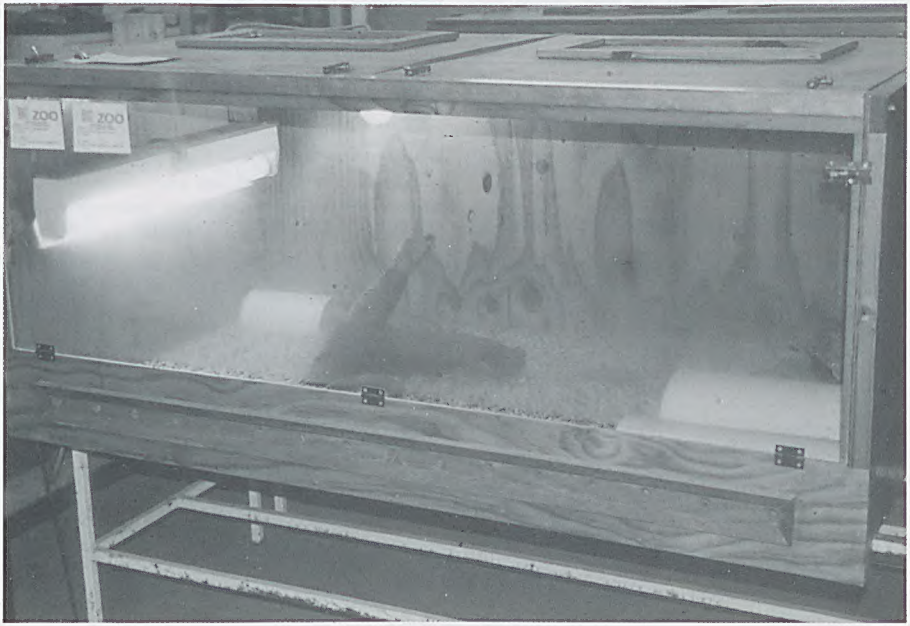
Both captive groups at Adelaide Zoo are fed three times a week on lizard mix, and twice a week in the cooler times of the year. The lizard mix contains apple, pear, carrot, lettuce, tomato, potato, cauliflower, broccoli, and shelled boiled egg both white and yolk. All are chopped into 5mm cubed pieces, and sprinkled with Rep-Cal Herptivite™ and Rep-Cal Calcium with VIT. D3 ™, mixed 1: 1. The mix is cut to this size to encourage biting by the skinks, as this keeps their teeth clean. When young are born, lizard mix chopped more finely is offered in another smaller, lower edged bowl. After about two weeks we return to the single bowl and 5mm cubed lizard mix. The food is left in the enclosure for 24 hours, but the appetite of the group varies greatly from day to day and the time of the year. They are fed insects at least once a month (mealworms, crickets, cockroaches or locusts) and pink mice on rare occasions. Fresh water is available at all times.

Cleaning

Both groups of lizards defecate in the one location in their respective enclosures. Faeces are removed from the exhibit every morning, but it is left in the off-limit cage for about a month. Because of this habit it makes partial cleaning of this area easy. Even after completely scrubbing the cage and moving the furnishings around the lizards will still utilise the same site.

Figure. 1. - Hosmer's Skink exhibit at Adelaide Zoo

Figure.2. - Hosmer's Skink off-limit enclosure at Adelaide Zoo.



Small pieces of shed skin are occasionally removed from the enclosures, but most of it is usually consumed by the skinks.

Heating

Half the roof of the exhibit is meshed so the ambient heat of the reptile house heats the exhibit. A natural daytime high and nighttime low occurs, but the exhibit also has floor heating and two suspended 200 watt ceramic heating globes. Both of these heating systems are run off individual thermostats. A 250-watt reflector globe is also used during the day to create a basking area. During warmer times of the year temperatures range from 28°C to 35°C, and 21°C to 25°C in the cooler period. There is no winter hibernation period. The spotlight highlights a rock mound, which the skinks regularly bask on during the day. The spotlight is on for 6.5 hours a day, usually from 1000 to 1630 hours. The off-limit cage also has large mesh vents, so it receives the same heating as the exhibit. In addition a 40-watt globe is attached to the roof for basking and operates from 1000 to 1630 hrs daily.

Lighting

Both the exhibit and the off-limit enclosures receive natural photoperiods from the windows that light the reptile house. Two 1.2m True-lites™ are used above the exhibit and a single 60cm True-lite™ in the off-limit cage to simulate natural daylight. These lights are run for eight and a half-hours a day, usually from 800 to 1630 hours.

BREEDING

The lizards are housed together within their two groups all year round. Copulatory behaviour is observed mainly in late August. This behaviour has included one skink continually following another skink around the enclosure, and one skink on top of another skink, and biting the lower one on the neck. By late November the females, if gravid, have increased enough in size to be noticeable. At this time young from the previous season are removed from the group. This is to prevent any interference with the females giving birth, and also to stop any aggression towards the newborn lizards.

The litter size varies from one to four with a mean of two, based on the 21 litters born at Adelaide Zoo. This is usually a seasonal event, with young being born in the last week of December or the first week in January. However, on one occasion the same pair produced two litters in one season. The first litter, of two, was born in mid-November followed by a single animal in mid-April. The husbandry practices for the season were the same as all other breeding seasons. Only two stillborn animals have been recorded. Gestation is 115 days.

Based on a sample size of six litters, the young range from 66 to 73mm snout vent length (mean. 70.3mm, SD 2.5mm), and had a mean total length of 113.3mm. (Range 104 to 119mm, SD 5.4mm). These twelve animals had a mean mass of 10.4g (range 8.3 to 11.5g, SD 1g).

Two female skinks, born in December 1991 were introduced to a male in May 1993. Both of the females successfully reproduced in the 1994-breeding season, suggesting that females are sexually mature at three years of age. The male that mated both of these females was born in 1989, indicating males are sexually mature by five years of age. On one occasion a female was observed giving birth in the late morning. The female seemed very particular about sitting in a position so that her vent was clear of the ground. She also panted with an open mouth before she was about to push. A total of four young were born, although only the last two were observed. The first of these, after taking a few minutes to breathe, ate its foetal membranes. The last young was a lot smaller than the others, less than one third of the average body weight, and was not included in the above data. This animal was obviously not as developed as the others, as its foetal membranes were mainly yolk. The female waited for the baby to move, checking it every few minutes. After about 20 minutes she ate the large yolk sac, leaving the young still alive and breathing. It was alive at the end of the day, but was dead the next morning in the same position in which it was left. The birth of these last two young took about forty minutes, but I believe it would have been much quicker if she had not been aware of my presence, as every time she picked up on

my movement she seemed to take about five minutes to return to what she was doing.

LONGEVITY

The current exhibit group male is ten years of age and both females are nine years old. The off-limit pair of skinks were public donations in November 1991. When they arrived they were both adult size and reproduced that same year, in late December. Therefore, by using the sexual maturity ages from the breeding section the female should be at least 12 years of age.

BEHAVIOUR

The skinks become active soon after their basking lights are turned on and are active for most of the day. The exhibit animals are rarely seen to use the branches, but they regularly and easily climb up the vertical artificial rock walls and rocks. However, the off-limit group, which only have branches and no rocks, do use their branches regularly. In the past we have encountered yearling skinks being aggressive to the neonates. For this reason yearling skinks are now removed before young are born. On two occasions an adult skink was observed chasing and biting the end off the tail of a young skink. One of the skinks was a newborn and the other was about ten months old when the aggression occurred. In both of these cases the young skinks were removed from the group and their tails completely grew back. Each scale on the new grown tail seemed quite blunt and looked a little different to the normal ones. (Fig.3.) Both of the groups include only one adult male, as adult males can be extremely aggressive to each other. The aggression can be so extreme that individuals may loose limbs or a tail when fighting.

DISCUSSION

The litter size of up to four reported here for *E. hosmeri*, is similar to that recorded for other rough-scaled, rock dwelling *Egernia* species, except for *E. cunninghami* and *E. striolata*, which have up to eight and six respectively (Greer, 1989).

The phenomenon of newborn Hosmer's Skinks eating the foetal membranes has also been observed in other *Egernia* species, such as *E. cunninghami* and *E. stokesii*. This is also reported for the larger species of *Tiliqua*, such as *T. nigrolutea, T. scincoides* and *T. rugosa* (Greer 1989: 129,134). My observation of the mother eating the foetal membranes has also been seen with *E. cunninghami* (Niekisch, 1975 (cited in Greer, 1989). There is no record in *Tiliqua* of the female biting the umbilical cord or eating the foetal membranes (Greer, 1989)

The gestation period of 115 days, is comparable with the 104 days recorded at Melbourne Zoo (Slavens, 1999).

The unusual occurrence of a pair producing two litters in one season has happened once at Adelaide Zoo and has not been repeated since. It is suggested that the closely related

Figure.3. - Hosmer's Skinks regrown tail after four weeks. (T. Morley)

viviparous species, *E. cunninghami*, due to its longer gestation period, only produce one litter per season (Barwick, 1965 [cited in Greer, 1989]). There is indirect evidence that *E. inornata* may produce two broods per season (Pianka & Giles, 1982 [cited in Greer, 1989]). I have not yet found any records of two litters per season in species in the closely related genus *Tiliqua*.

Scats of wild Hosmer's Skinks suggest that they are mainly herbivorous, feeding on plant material. Small amounts of animal material were also found such as shed *E. hosmeri* skin, insect remains, and in one scat a segment of a land snail shell (Shea, 1995).

It has been recorded on a number of occasions that *Egernia* species have communal defecation sites (Greer 1989).

The female lizards have proved to be sexually mature at three years of age, and males at five years. I believe that males are sexually mature earlier, but currently we have no data to support this.

Philadelphia Zoo has a record of a male Hosmer's Skink living in their collection for 24 years and 6 months. It was acquired on 15 July 1972, was wild born, and died on 2 February 1997 (Slavens, 1999).

CONCLUSION

Overall the Hosmers Skink is very hardy and easy to keep in captivity. This species will readily reproduce every year, once sexually mature and in a compatible group, if kept under the correct conditions.

ACKNOWLEDGEMENTS

I would like to thank Terry Morley and Dr Angus Martin for their input and revising of various drafts of this paper. Ed McAlister and Mark Craig also read the final manuscript. Also thanks to the keepers who returned information on the many offspring that were bred at Adelaide Zoo, but have subsequently been sent to other institutions.

PRODUCTS MENTIONED

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REFERENCES

Banks, C.B. 1986. Captive breeding of three species of the Australian skink genus *Egernia*. pp. 105- 118 in, Peterson, K.H. (ed.). Proceedings of the 10th International Symposium on Captive Propagation and Husbandry. San Antonio.

Barwick, R.E. 1965. Studies on the scincid lizard *Egernia cunninghami* (Gray 1832). Unpublished Ph.D. Thesis, Australian National University, Canberra; 177pp.

Cogger, H.G. 1996. Reptiles and Amphibians of Australia (5th edition with amendments). Reed Books, Port Melbourne Victoria.

Ehmann, H. 1992. Encyclopedia of Australian Animals. Reptiles. Angus & Robertson, Sydney.

Greer, A.E. 1989. The Biology and Evolution of Australian Lizards. Surrey Beatty and Sons, Chipping Norton.

Niekisch, M. 1975. Pflege und Nachtzucht von *Egernia cunninghami* Salamandra 11 (3/4): 130-35.

Pianka, E.R. & Giles, W.F. 1982. Notes on the biology of two species of nocturnal skinks, *Egernia inornata* and *Egernia striata*, in the Great Victoria Desert. West. Aust. Nat. 15(2): 44 - 49.

Shea, G.M. 1995. Herbivory in *Egernia hosmeri* (Squamata: Scincidae) Herpetofauna 25 (2):8-11.

Slavens, F & Slavens, K. 1999. Reptiles and Amphibiansin captivity - Longevity - Home page. http://www.halcyon.com/slavens

RECORD OF THE GREEN-THIGHED FROG (*LITORIA BREVIPALMATA*) FROM NORTH-EAST NEW SOUTH WALES

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INTRODUCTION

The green-thighed frog (*Litoria brevipalmata*) is a small to medium sized (max. 47 mm) hylid frog found in coastal and sub coastal areas from near Bundaberg (Cordalba) in the north to Ourimbah in the south (Mahony 1993; Barker *et al.* 1995; Cogger 1995; Lemckert *et al.* 1997; Lemckert 1999; Murphy & Turnbill 1999). It is a relatively distinct species with a prominent white upper lip, armpits and groin marked in lime green with black markings (Barker *et al.* 1995; Cogger 1995; Lemckert 1999). Despite these distinct markings and relatively wide distribution, it is known from few areas (Mahony 1993; see Ehmann 1997; Lemckert *et al.* 1997; Murphy & Turnbill 1999). Its cryptic habits ensured it remained unknown to science until 1972 (Tyler *et al.* 1972). The main habitat requirement of *L. brevipalmata* is warm temperate lowland forest (Tyler 1992). More recent records have indicated other habitat types used e.g. dry sclerophyll forest in the northern part of its range (Nattrass & Ingram 1993; Lemckert 1999; Murphy & Turnbill 1999).

Litoria brevipalmata is uncommon in north-eastern NSW with <20 records in north-east NSW. It is often only seen during breeding events between October to April after local flooding (Mahony 1993; Barker *et al.* 1995; Ehmann 1997; Lemckert *et al.* 1997; Lemckert 1999). Males are frequently found perched on fallen tree branches above or close to still water (Barker *et al.* 1995; White 1995; Ehmann 1997; Lemckert *et al.* 1997).

Litoria brevipalmata is currently listed on schedule two of the NSW *Threatened Species Conservation Act* 1995. Factors implicated in the decline of *L. brevipalmata* include habitat destruction and modification particularly the coastal lowlands which apparently form important breeding habitats (Ehmann 1997; Lemckert *et al.* 1997; Lemckert 1999). The following is an observation of *L. brevipalmata* made in north-eastern NSW which extends regional records, habitat observations, and the period of adult activity.

OBSERVATION

On 22 May 1999 (11 00 hrs) an individual *L. brevipalmata* (SVL 32 mm Sex: M) was observed adjacent to a patch of Bush Lantana (*Lantana camara*). The site is located in the Bungawalbin catchment, a sub catchment of the Richmond River within the Casino Forestry Management Area. The actual location is situated in Gibberagee State Forest (152o 01′ E 29o 17′S; 25 m AHD) and has been subject to disturbance in the past (native vegetation clearance, pine plantation, old vehicle track). The immediate habitat consisted of disturbed riparian forest with an overstorey dominated by Waterhousia (*Waterhousia floribunda*), Pine Plantation (*Pinus radiata*), Camphor Laurel (*Cinnamomum camphora*), Silky Oak (*Grevillea robusta*), and Forest Red Gum (*Eucalyptus tereticornis*). The understorey vegetation included Bush Lantana, Privet species, various grasses (native & introduced), vine thickets, and Lomandra (*Lomandra longifolia*) along nearby Myall Creek. A flooded depression (7x4 m; max depth = 0.3 m) exposed to full sunlight was noted 30 m from the capture site. Subsequent inspection revealed a variety of tadpoles in both size and species, but no *L. brevipalmata* were identified. In addition, no hylid spawn masses were observed to suggest *L. brevipalmata* had recently bred at this site.

DISCUSSION

This recent sighting of *L. brevipalmata* brings the number of known locations in north-east NSW to 20. It is the first record of the species in the Bungawalbin catchment and only the fifth in the Richmond River catchment. This is despite previous surveys conducted in the Bungawalbin catchment for proposed forestry operations, numerous student surveys, authors' research, and probably a number of pre-logging surveys. However, some records do exist in close proximity further to the south near Whiporie (Murphy & Turnbill 1999). The recent discovery in the Bungawalbin catchment highlights the difficulties associated with surveys for *L. brevipalmata* (see Ehmann 1997; Lemckert *et al.* 1997).

The site also showed evidence of considerable disturbance in the past from a number of agricultural and forestry practices. Much of the Bungawalbin catchment has undergone modification for agriculture and forestry operations. However, large areas of potential habitat remain for *L. brevipalmata* despite continuing threats from agriculture, forestry operations, and cattle grazing. In particular, tea tree farming is continuing to expand in the Bungawalbin catchment and often utilises land that is apparently suitable for *L. brevipalmata*. Interestingly, disturbance and habitat modification occur at many known sites (Ehmann 1997; Lemckert *et al.* 1997). However, this should not be a cause for complacency because little is known about the habitat requirements of *L. brevipalmata* outside breeding sites.

Until recently, few known populations of *L. brevipalmata* existed within conservation reserves. However, the recent forestry agreements and further land acquisition by NSW National Parks and Wildlife Service has provided several populations with increased protection in north-east NSW. The Bungawalbin catchment has recently acquired additional conservation reserves (Bungawalbin & Mt Pikapene National Parks) which exhibit suitable habitat for *L. brevipalmata* (pers obs). Bungawalbin Nature Reserve (460 ha) was the only conservation reserve in the Bungawalbin catchment (1227 km2) before 1999. Future frog surveys should incorporate sites within these reserve systems to adequately assess their status within protected areas of the Bungawalbin.

The habitat type where the specimen was located conforms to that described by others (e.g. Ehmann 1997; Lemckert *et al.* 1997). Other suitable forest types including wet sclerophyll and rainforest do not occur in the vicinity (5 km radius) of the site. The "wettest" forest type is the riparian forest (*Waterhousia floribunda* dominant) which has undergone modification. This habitat may provide a refuge for adults during stochastic environmental events such as fire and drought.

It was interesting that the frog was still active at this time of the year (late autumn). Other research/observations suggest thaxt activity/breeding occurs between October-April (Barker *et al.* 1995; Ehmann 1997; Lemckert *et al.* 1997; Lemckert 1999). This observation represents a further extension to the previous known activity for the species. The extensive wet period that occurred in the region may have been a factor with approximately 1600 mm rainfall (January-May) before the observation.

It is not known whether breeding took place at the nearby flooded depression. Based on previous experience and published accounts (e.g. Barker *et al.* 1995; White 1995; Ehmann 1997; Lemckert *et al.* 1997) the habitat at this site appears suitable for breeding. The ephemeral pond is exposed to sunlight, relatively shallow (<30 cm deep), and exhibits both submerged and emergent vegetation. Follow up surveys targeting metamorphs and juvenile frogs may determine if breeding occurred.

Appropriate management of *L. brevipalmata* is difficult because its cryptic habits have lead to a paucity of information. Management at this site is probably not required at this stage. Despite the flooded depression occurring on a vehicle track, it is not often used and has

naturally revegetated considerably over the past 12 months (pers obs). Future surveys targeting *L. brevipalmata* are required throughout the Bungawalbin catchment during significant rainfall events to fully assess its status. In addition, continued monitoring of this potential breeding site will help to determine the importance of this site to *L. brevipalmata*.

REFERENCES

Barker, J; Grigg, G; and Tyler, M.J. 1995. A field guide to Australian Frogs. Surrey Beauty and Sons, Chipping Norton, NSW.

Cogger, H.G. 1995. Reptiles and Amphibians of Australia. 5th edition. Reed Books, Sydney.

Ehmann, H. 1997. Threatened Frogs of New South Wales. Habitats, Status and Conservation. Green-thighed Frog. Published by Frog and Tadpole Study Group of NSW Inc, PO Box A2405, Sydney South 2000.

Lemckert, F; Mahony, M; & Slatyer, C. 1997. The Green-thighed Frog in the Bulahdelah Region. Unpub report to the RTA.

Lemckert, F. 1999. Frog information file: Green-thighed Frog (*Litoria brevipalmata*). Pp 4 Frogcall Newsletter (August)

Mahony, M.J. 1993. The status of frogs in the Watagan Mountains area of the central coast of New South Wales. Pp. 257-64 in Herpetology in Australia: a Diverse Discipline ed by D. Lunney and D. Ayers. Trans. Royal. Zool. Soc. New South Wales: Mosman

Murphy, M.J & Turnbill, J. 1999. A new locality for the threatened Green-thighed Frog (*Litoria brevipalmata*) in coastal northeast New South Wales. Australian Zoologist 31 (1) 225-9.

Nattrass, A.E.O & Ingram, G.J. 1993. New records of the rare Green-thighed Frog. Mem. Qld Mus. 33 (1):348.

Tyler, M.J; Martin, A.A; & Watson, G.F. 1972. A new species of Hylid frog from New South Wales. Proc. Linn.Soc. NSW. 97 (1): 82-6/

Tyler, M. 1992. Encyclopaedia of Australian Animals-Frogs. The National Photographic Index of Australian Wildlife. The Australian Museum/Angus and Robertson Pub. Sydney.

White, A. 1995. Fauna Impact Statement - Amphibians, Green-thighed Frog. Unpub. Report for Casino Management Area Fauna Impact Statement to State Forests of NSW, Pennant Hills.

AN UNUSUALLY PATTERNED SPOTTED PYTHON, *ANTARESIA MACULOSA*, FROM JOURAMA FALLS, QUEENSLAND

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Australian pythons are often polymorphic in colour pattern and may undergo extensive ontogenetic change in colouration. However, incidences of albinism or exceptionally unusual colour patterns in wild-caught animals are rare (e.g., Bedford and Coward, 1995). According to Greer (1997), Australasian pythons occasionally are seen which lack pigmentation on certain parts of their body, such as the partial albino *Aspidites melanocephalus* pictured in Shine (1991). To date, no partially pigmented or albino specimens of the spotted python, *Antaresia maculosa*, have been reported from wild populations.

On August 8, 1983, I captured an unusually patterned spotted python while hiking the trail to Jourama Falls, Jourama Falls National Park (24 km south of Ingham), Queensland (Figure 1). The snake was captured in the early afternoon as it crawled at an interface between a rocky and grassy area. The day was warm and pleasant with a minimum of cloud cover. As is common with the species, it made no attempt to bite. Unfortunately, I was not able to determine its sex or exact length. Wild-caught spotted pythons average 50 cm snout-vent length for males and 62 cm snout-vent length for females (Shine and Slip. 1990). Given that the tail length of spotted pythons is ca. 10% of total length (TL) (Smith, 1985), my estimate of 75 to 85 TL cm place the specimen as a small adult. After examination and photography, the snake was released at the point of capture.

Figure 1 clearly shows two white patches on the dorsal surface of the snake, a small triangular section behind the head and a much more irregularly-shaped section approximately 15cm from the snout and extending along the snake's left lateral side. The white patches were clearly demarcated from adjacent scales, that is, the scales in or next to the white patches were either all white or all dark. White pigmented scales were confined only to the dorsal and lateral sides of the snake and did not extend to the ventral scutes. Careful examination of the snake revealed no sign of trauma or injury, such as scar tissue, which might account for the white colouring; scales within the white area were normal in size, shape and texture. In other respects, the snake appeared to have the normal colouration of spotted pythons (see Barker and Barker,1994).

The correct term for the pattern shown by the Jourama Falls spotted python is piebald, defined as "spotted or patched, especially in black and white" (Bechtel, 1995). Piebald snakes are rather uncommon in wild populations. Gloyd (1958) described a piebald prairie rattlesnake, *Crotalus viridis*, from the northern plains region of the American midwest, and Bechtel (1995) mentions a piebald wild-caught corn snake, *Elaphe guttata*, from Florida. Piebald snakes occasionally have been reported by snake breeders. In American corn snakes, piebaldism may have a hereditary basis and be delayed in onset, that is, until after several sheds (J. Cowles, in Bechtel, 1995). Nothing else is known concerning the incidence of piebaldism in snakes. The Jourama Falls *Antaresia maculosa* appears to be the first wild-caught piebald python in Australia.

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REFERENCES

Barker, D.G. and Barker, T.M. 1994. Pythons of the World, Volume 1, Australia. Advanced Vivarium Systems, Lakeside, California. 171 pp.

Bechtel, H. B. 1995. Reptile and Amphibian Variants. Colors, Patterns, and Scales. Krieger Publishing Company, Malabar, Florida. 206 pp.

Bedford, G. S. and Coward, R. 1995. Life history notes: *Liasis olivaceus* (Olive Python). Albinism. Herp. Rev. 26(l): 39.

Gloyd, H. K. 1958. Aberrations in the color patterns of some crotalid snakes. Bull. Chicago Acad. Sci. 10(12): 185-195.

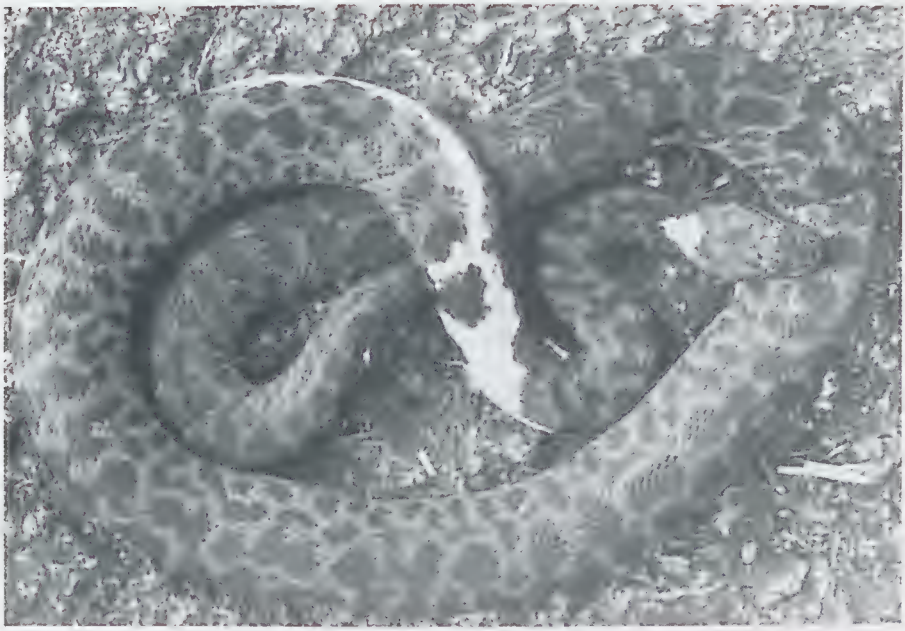
Greer, A. 1997. The Biology and Evolution of Australian Snakes. Surrey Beatty & Sons Pty Limited, Chipping Norton. 358pp.

Shine, R. 1991. Australian Snakes. A Natural History. Reed Books, Balgowlah. 223 pp.

Shine, R. and Slip, D.J. 1990. Biological aspects of the adaptive radiation of Australian Pythons (Serpentes: Boidae). Herpetologica 46(3): 283-290.

Smith, L.A. 1985. A revision of the *Liasis childreni* species-group (Serpentes: Boidae). Rec. West. Aust. Mus. 12(2): 257-276.

Figure 1. Piebald *Antaresia maculosa*, Jourama Falls National Park, Queensland. August 8,1983.



PATHOLOGY OF A LIMB BONE IN THE ESTUARINE CROCODILE *CROCODYLUS POROSUS*.

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A wide variety of injuries have been recorded amongst extant crocodilians including *Crocodylus niloticus* (Cott 1961), *C. johnstoni* (Webb and Manolis 1983), *C. porosus* (Webb and Messel 1977) and *Caiman c. crocodilus* (Staton and Dixon 1975; Gorzula 1978). These often occur during intraspecific fighting between animals during territorial disputes and dominance displays. This is particularly common amongst males with wounds, amputations and death sometimes resulting (Hornaday 1875, Cory 1896, McIlhenny 1935, Pitman 1941, Cott 1961, Webb and Messell 1977, Webb and Manolis 1983). There have also been records of injury from the fossil record (Buffetaut 1983, Williamson 1996, Mackness and Sutton (2000).

This note describes a pathological left humerus from an estuarine crocodile, *Crocodylus porosus* from northern Australia. The specimen (Fig. 1) came from a wild caught adult male, and was one of 31 partial skeletons of varying age classes collected from deceased or recently harvested individuals at a crocodile farm. The skeletons are currently under examination by the author as part of an ongoing study into crocodilian ontogenetic development.

The humerus (L = 21.7 cm) is robust and from a large animal. It compares well with a humerus (QM J47474; L = 24.6 cm) of another large crocodile in the Queensland Museum. The topography of this bone appears normal except for a region of obvious pathology and a noticeable curvature of the distal third of the diaphysis. To establish the degree of this curvature, an axis was defined on a non-pathological humerus by running a straight line from the external edge of the caudolateral tubercle, along the craniomedial crest (deltoid crest of other authors) to the centre of the intercondylar sulcus. The abnormal bone had a medial deflection of the diaphysis of 35° from this axis. There was no cranial or caudal curvature of the bone.

The humerus, along with several other limb bones from the same animal, was radiographed to establish whether the curvature was a result of poor nutrition. There was no diagnostic change in the thickness of the cortex walls, normally associated with nutritional deficiencies (Baker & Brothwell 1980), and no other pathology or curvature noted in any of the other bones examined. It was therefore assumed that the humeral curvature had a different aetiology.

A radiograph of the pathology revealed a lucent, clearly demarcated area 22 mm x 15 mm with small opaque areas of similar density to bone, within it. These were interpreted as possible sequestra. There was also a lucent track leading from the medial side of this area to the periphery of the cortex. This was interpreted as a sinus. There were at least two other sinuses with proliferative bone growth around their external openings on the lateral side of the cortex. The radiograph also showed an area of bone thickening in the region of the pathology, similar to that found in a healed fracture, but no fracture planes were visible.

The curvature seen in the distal portion of the bone may have had one or a combination of causes. The force of an initial bite may have resulted in a linear fracture with the bone healing in an offset position. An alternative may have been that the trauma caused an infection and the pressure resulting from the inflammatory exudate may have also stimu-

lated the removal of bone by osteoclasts. This would have resulted in the bone being weakened until it fractured due to its mechanical strength being greatly reduced.

The pathology exhibited is most consistent with that caused by a localised trauma and a subsequent episode of osteomyelitis resulting from bone and deep tissue damage. Infection most likely invaded the initial wounds and extended into the bone. A combination of inflammatory exudate causing elevation of the periosteum and bone fragmentation as a result of the trauma would have resulted in the blood supply being cut off to some areas of bone which had become sequestered. This would have been enhanced by the continual destruction of bone from infection.

Meanwhile, the elevated periosteum would have continued to produce new bone. A cycle of new bone deposition and elevation would have continued leading to the degree of proliferation noted on the x-ray. This was most pronounced around the sinuses which would have been draining the deep infection. While the sinus formation could have arisen from rupture of the elevated periosteum, they more likely reflect the deep penetrating wounds of an attack.

The injury sustained was probably the result of an attack by another large, presumably male, crocodile during intraspecific aggression and perhaps during the mating season (Meyer 1984). Crocodiles often attack each other from below with the tail and limbs being the main targets. The nature of the majority of injuries suggests a single bite or open mouthed slash (Webb and Manolis 1983). Crocodilians are capable of producing considerable bite forces (Busbey 1989, Cleuren *et al.* 1995) that can easily crush limb bones and even skulls of large animals such as feral pigs *Sus scrofa* (Webb & Manolis 1989). In their examination of 1345 specimens of *Crocodylus porosus*, Webb and Messel (1977) found that 29% of animals had limb injuries with the most common being an amputated digit, accounting for 64% of all limb injuries. Judging from the proliferative bone growth, the injured crocodile lived on for some time. Crocodiles have a great ability to recuperate from all but the most serious injuries (Gorzula 1978, Brazaitis 1981). The injury however, may have had an effect of the individuals ability to respond to further attacks as it eventually died during a further aggressive encounter (N.Stevens pers. comm.).

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REFERENCES

Baker, J. & Brothwell, D. 1980. Animal diseases in Archaeology. Academic Press, London

Brazaitis, P. 1981. Maxillary regeneration in a marsh crocodile, *Crocodylus palustris*. Journal of Herpetology 15:360-362.

Buffetaut, E. 1983. Wounds on the jaw of an Eocene mesosuchian crocodilian as possible evidence for the antiquity of crocodilian intraspecific fighting behaviour. Paläontologische Zeitschrift 57:143-145.

Busbey, A.B. 1989. Form and function of the feeding apparatus of *Alligator mississippensis*. Journal of Morphology 202:99-127.

Cleuren, J., Aerts, P., De Vree, P. & De Vree, F. 1995. Bite and joint force in *Caiman crocodilus*. Belgian Journal of Zoology 125:79-94.

Cory, C.B. 1896. Hunting and fishing in Florida, including a key to the water birds. Second edition. Estes and Lauriat, Boston.

Cott, H.B. 1961. Scientific results of an inquiry into the ecology and economic status of the Nile crocodile (*Crocodylus niloticus*) in Uganda and northern Rhodesia. Transactions

of the Zoological Society of London 29:211-337.

Gorzula, S.J. 1978. An ecological study of *Caiman crocodilus crocodilus* inhabiting savanna lagoons in the Venezuelan Gayana. Oecologia, Berlin 34:21-34.

Hornaday, W.T. 1875. The crocodile in Florida. American Naturalist 9:1-6.

McIlhenny, E.Q. 1935. The alligator's life history. Christopher Publications, Boston

Mackness, B.S. & Sutton, R.H. 2000. Evidence for intraspecific aggression in a Pliocene crocodile from northern Australia? Alcheringa 24:55-62.

Meyer, E.R. 1984. Crocodiles as living fossils. In N. Eldredge and S.M. Stanley (eds.), Living Fossils, pp.105-131. Springer-Verlag, New York.

Pitman, C.R.S. 1941. About crocodiles. Uganda Journal 9:89-114.

Staton, M.A. & Dixon, J.R. 1975. Studies on the dry season biology of *Caiman crocodilus crocodilus* from the Venezuelan Ilanos. Memoria de la Sociedad de Ciencias Naturales La Salle 35:237-265.

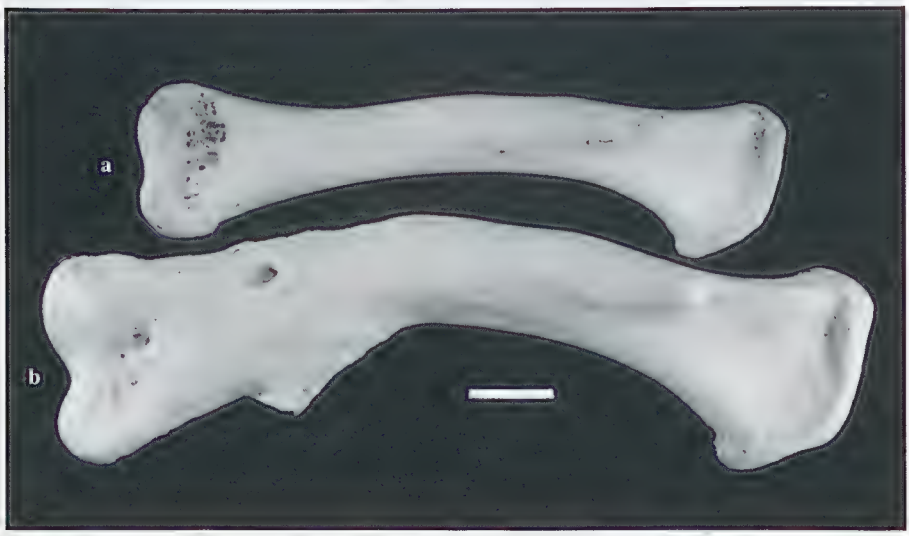
Webb, G.J.W. & Manolis, S.C. 1983. *Crocodylus johnstoni* in McKinlay River Area, N.T. V.* Abnormalities and Injuries. Australian Wildlife Research 10:407-420.

Webb, G.J.W. & Manolis, S.C. 1989. Crocodiles of Australia. Reed Books, Frenchs Forest.

Webb, G.J.W. & Messel, H. 1977. Abnormalities and injuries in the estuarine crocodile, *Crocodylus porosus*. Australian Wildlife Research 4:311-319.

Williamson, T.E. 1996. *?Brachychampsa sealeyi*, sp. nov., (Crocodylia, Alligatoroidea) from the Upper Cretaceous (Lower Campian) Menefee Formation, northwestern New Mexico. Journal of Vertebrate Paleontology 16:421-431.

Figure. 1. Two left humeri of *Crocodylus porosus*. a, sub-adult b, pathological specimen showing marked curvature and proliferative bone growth. Scale Bar = 2cm.



AN OCCURRENCE OF A RED-EARED TURTLE (*TRACHEMYS SCRIPTA ELEGANS*) IN THE WAIKATO RIVER AT HAMILTON, NEW ZEALAND

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INTRODUCTION

The red-eared turtle (*Trachemys scripta elegans*) is a subspecies of the slider (*Trachemys scripta*) and is the most commonly kept turtle in captivity in New Zealand. It is native to the Mississippi Valley, from Illinois to the Gulf of Mexico (Ernst and Barbour, 1972). This species has been successfully introduced into a variety of waterways in the U.S. and elsewhere, including at least five localities in southern Florida (Ashton and Ashton, 1991). In New Zealand reports of sightings in the past have come from such places as Northland, Otorohanga, Huntly (both in the Waikato region), and Lower Hutt (Wellington region). It is important to note however that there are no confirmed reports of breeding in New Zealand and these reported sightings are almost certainly of escaped or deliberately released pet animals.

OBSERVATION

Date: 24 th October 1999

Time: 14:10 New Zealand Time.

Locality: 300 metres upstream from Cobham Bridge, Hamilton, New Zealand (37°49S X 175° 19E).

Weather conditions: Overcast, approximately 70% cloud cover. 16°C.

Habitat: Riverbank overhung by mature crack willow trees (*Salix fragilis*). Water slow moving at margin of river due to stranded logs and drooping willow boughs disrupting flow.

Species observed: Red-eared turtle (*T.scripta elegans*). Specimen had distinct red patch behind eye. Pleural scutes of carapace had a yellow stripe. Yellow stripes on chin. Plastral scutes possessed dark blotches. These markings distinguish the subspecies *T. scripta elegans* from *T. scripta* itself and other *T. scripta* subspecies (Ernst and Barbour, 1972; Dawson, 2000).

Size of specimen: Carapace 200mm long

Sex of specimen: Male (long tail, sizeable extended claws on forelimbs).

Notes: The specimen when first observed was submerged under approximately 300mm of water, and was approximately 500mm from the bank of the river. It was slowly walking along the substrate of the river, which consisted solely of exposed willow tree roots. We captured the turtle in a handnet for closer observation. The turtle appeared to be in good condition, with a clean shell showing little algal growth. The turtle was released after these observations were made. Further searching of the riverbank on this and subsequent dates failed to reveal the presence of other turtles.

DISCUSSION

Red-eared turtles are offered for sale by a large number of pet shops in New Zealand, and it appears highly likely that the turtle we observed was a released or escaped pet. Large numbers of red-eared turtles were imported into New Zealand in 1963-64 from Maryland USA, but importation was banned afterwards by the Department of Agriculture due to a potential human health risk due to the possible transmission of *Salmonella* from the turtles to man (Robb, 1980). Most of the captive New Zealand population is derived from that stock. Specimens of this turtle, presumably also released/escaped pets, have been reported previously in the literature from Huntly, which is also in the Waikato region (Hudson and Thornton, 1994). Other reports of sightings in the wild in New Zealand come from Lower Hutt in the 1970's (T. Whitaker pers. com.), the Otorohanga Zoo duck pond

and the Hamilton Zoo wetlands enclosure (both reports N. Webb pers. com.). Four red-eared turtles were reported previously in the wild in Northland. Two of these specimens were escaped pets and were found within a mile of where they had previously been kept in captivity. One animal was at large for three years, the other for two years (M. Feldman pers. com.). There are also alleged sightings of turtles (species unknown) from lakes and ponds in the Auckland and Waikato region, but these reports need to be confirmed (T. Whitaker pers. com.). It can be seen from the sizable number of reports from many parts of the North Island of New Zealand that a fair number of individual red-eared turtles have been or still are present in the wild in New Zealand. It is important to note however that there have been no confirmed reports of breeding in the wild in New Zealand and it is highly likely that all of the specimens reported above are released/escaped captive animals.

Two interesting questions arise as a result of our observation. The first is whether a red-eared turtle could survive long-term in the wild in New Zealand's Waikato River. The second question is whether a breeding population of this species could become established here.

Released red-eared turtles have over-wintered successfully in Ontario, Canada (Oldham and Sutherland, 1986), therefore wild specimens in the Hamilton, New Zealand region should have little problem coping with winter temperatures experienced there. Indeed captive animals have been successfully over-wintered out of doors in Tokoroa, which is also in the Waikato region (N. Webb pers. com.). Adult turtles are almost solely aquatic and feed predominately on aquatic macrophytes (Texas parks and wildlife factsheet, 2000). The Waikato River at the locality that we made our turtle observation has extensive beds of oxygen weed (*Egeria densa*) along with other species, these macrophytes should offer a year round food supply. It is therefore likely that a red-eared turtle could live out the remainder of its life in the wild in the Hamilton, New Zealand region. There is more doubt surrounding the question of whether these turtles could establish a breeding population here. Assuming of course that a female was also present then it is possible that a nest could be built and fertile eggs laid. However, the likelihood of a self-sustaining breeding population becoming established may be limited by the fact that this species shows temperature-dependant sex determination, and that they require high nest temperatures for extended periods of time. At low incubation temperatures (26°C for example) all hatchlings are male, but at higher temperatures (31°C) all hatchlings are female (Wibbels and Crews, 1992). Therefore the long-term survival of a breeding population depends on a range of relatively warm nest temperatures for extended periods. It is remotely possible however that these conditions may be met in certain microclimates along the Waikato River, especially if the nest was built among decomposing, and hence heat producing vegetation. Young red-eared turtles are almost exclusively carnivorous (Texas parks and wildlife factsheet) and feed on such items as worms, snails and aquatic invertebrates. There would appear to be quite high numbers of such food items present along the Waikato River at Hamilton (pers. obs.). In conclusion when all of the above mentioned facts are taken together it would appear unlikely, although possible that red-eared turtles would breed successfully along the Waikato River. It is likely however that the specimen we observed would be able to live out the remainder of its life in the wild in the Waikato River at Hamilton, New Zealand.

ACKNOWLEDGEMENTS

Acknowledgements are due to Mark Feldman, Nick Webb, Tony Whitaker and other members of the NZ Herpetological Society for information on turtle sightings and other helpful advice. Many thanks to the reviewers of this paper for helpful suggestions, and a special thanks to my four year-old daughter Ashley Thomas for her enthusiasm at the time of the original observation.

REFERENCES

Ashton, R. E., and P. S. Ashton. 1991. Handbook of reptiles and amphibians of Florida. Part Two: Lizards. turtles and crocodilians. Windward Publishing, Miami, Fla. 191 pp.

Dawson, J. 2000. The turtle pages- slider. Website can be accessed on the internet at http://www.crosswinds.net/theturtlepages/species/t_scripta/index.html

Ernst, C. H., and R. W. Barbour. 1972. Turtles of the United States. University Press of Kentucky. Lexington, Ky. 347 pp.

Hudson, B., and T. J. Thornton. 1994. Reptiles and amphibians in New Zealand. Handbook for species identification. Print media specialists. 50 pp.

Oldham, M. J., and D. A. Sutherland. 1986. Ontario herpetofaunal summary 1984. Essex region conservation authority, Essex, Ontario. 214 pp.

Robb, J. 1980. New Zealand amphibians and reptiles in colour. Collins. 119pp.

Texas parks and wildlife factsheet. 2000. Red-eared Turtles. 1 pp. Factsheet can be accessed via the internet at: http://tpwd.state.tx/us/nature/wild/reptiles/slide r.htm

Wibbels, T., and D. Crews. 1992. Specificity of steroid hormone-induced sex determination in a turtle. Journal of Endocrinology 133; 121-129.

THE SUCCESSFUL BREEDING OF THE PALE-HEADED SNAKE, *HOPLOCEPHALUS BITORQUATUS* (JAN, 1859).

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INTRODUCTION

The genus *Hoplocephalus* contains three species, the Pale-headed snake (*H. bitorquatus*), the Broad-headed snake (*H. bungaroides*), and the Stephens Banded snake (*H. stephensii*). The three species all occur on the eastern mainland of Australia, and all are arboreal.

H. bitorquatus, like the rest of the genus, possess laterally keeled ventrals which help in their tree-climbing life-style. This species does however spend part of the time on the ground when moving about nocturnally (pers. obs.).

In *H. bitorquatus*, females are larger than males with a mean snout-vent length (SVL) of 52cm compared with the mean male SVL 46cm. (Shine, 1991). Adult males range from 36.2cm to 57.2cm SVL; females range from 38.4cm to 78.0cm SVL (Shine 1983). These measurements were derived from preserved specimens and may differ from field measurements. The average length of the females used in my breeding program is 70cm.

The distribution of *H. bitorquatus* is from the central coast of NSW in the south, to just north of Cairns in North Queensland. It appears to have a patchy distribution between the Atherton Tablelands and the Mackay district (Longmore, 1986).

This species appears to favour habitats bordering waterways including rivers, creeks, billabongs etc. In an ongoing survey I have found approximately 90% of individuals in association with the River Red Gum (*Eucalyptus camaldulensis*). This percentage has been taken from 51 specimens found in a two year period from November 1998 to November 2000. This habitat preference is probably the snake's choice, though destruction of other habitats may have had an effect.

I have been successful in breeding this species, resulting in several litters. However I have been unsuccessful in breeding them in successive years. No captive breeding papers have been published on this species to my knowledge, though breeding appears to be reasonably easy.

HOUSING

My Pale-headed snakes are housed in wooden cabinets incorporating sliding glass fronts, overhead lighting and heating. The cabinets are approximately 1 metre long, by 40cm deep and 40cm high. The substrate used in the cabinets is the artificial grass known as Astro-Turf. This is easy to remove for cleaning, and I keep spare sets to replace those removed for cleaning.

Water is provided in small unspillable earthen-ware containers which are easy to clean. Water is provided on an irregular basis to keep the humidity low within the cabinets. Fresh water is provided every two to three weeks or more frequently during hot weather when the snakes may coil up in the water or coil around the water containers. The snakes are frequently observed drinking and also have a tendency to coil up in the empty containers.

Hollow logs about 30cm long and with the diameter of the hollow from 2 to 6cm are placed on the floor of the cabinets, with similar sized logs on the side and back walls. Some branches are provided for climbing. I have installed a small platform about 10cm from the roof on which the snakes can coil to absorb either heat from the heating globes or the rays from an UV tube. This platform is situated approximately 13 to 15cm from the heating and UV sources.

The UV tubes are 60cm/18watt Sylvania Reptistar brand providing both UVA and UVB rays. These tubes are occasionally turned on

manually when the snakes are observed resting on the platforms, but this is kept to a minimum because of their nocturnal habits.

Heating is provided by normal light globes mounted in an overhead 122cm fluorescent reflective housing, and the wattage of these globes is varied from 40 to 60 watts depending on the time of year. Illumination is provided either by normal light globes of a low wattage or by fluorescent tubes.

Heating is thermostatically controlled and this is varied to the time of the year. The temperature is set to approximately 25 to 30°C during spring. Gravid females receive a longer period of heating until the hotter summer temperatures are reached, at which time no heating is provided. No heating is provided during winter as the snakes are held inside the house.

Illumination is controlled by a timer, with the lights coming on at 07.00 hours and switching off at 18.00 hours. Heating is also controlled through a timer set at the above times so that the temperature at night drops as it would naturally.

A manually controlled blue globe night light is set up. Two small air-flow fans are installed, one at each end of the cabinet. One forces air into the cabinet while the other expels air to create a stream of fresh air and simulate wind through the branches. This is manually controlled.

Ambient air temperature within the cabinets is monitored by a alcohol thermometer or by digital thermometers. In winter the temperature may fall to slightly higher than the outside temperature. In summer the temperature may reach 40°C.

FEEDING

In the wild *H. bitorquatus* feed mainly on geckos, skinks and tree frogs (Shine, 1983). One specimen I found regurgitated a Peron's Tree Frog (*Litoria peronii*).

My snakes are only fed laboratory mice and occasionally pinky laboratory rats. These are offered live, freshly killed or stunned. I do not use thawed-out frozen mice. The snakes are separated during feeding.

The Pale-headed snake is an opportunistic feeder in the wild and can fast for long periods. I try to simulate this in captivity, and my adult snakes would be offered, on average, 7 adult mice per year.

The snakes are wormed annually with Ivomec at the rate of 0.1ml per 40gms of body weight, diluted at 0.1ml per I ml of water. This is injected into a mouse as it is being eaten by the snake.

REPRODUCTION

Sexes are determined visually by tail shape, and this has proved successful without the need for probing. In males the tail is shorter and tapers more suddenly, while in females the tail is longer with a gradual taper. One male is kept with one or more females from late autumn to mid spring. The male is removed once the females are gravid or by mid spring. The male is placed in the cabinet housing the females, and males are rotated around the females during this time.

On one occasion during spring, I introduced a second male into a cage containing a male and two females. The resident, larger, male bit the smaller introduced male on the dorsal surface, after which the smaller male retreated into a hollow limb and remained there until I removed it several days later.

The bitten snake subsequently had a problem at it's next slough with a small (6mm x 25mm) section of bare flesh showing upon sloughing. No medication was administered, and the wound gradually healed with successive sloughs. The snake appears quite healthy and has since successfully mated with one of the females.

I have observed and photographed captive Pale-headed snakes mating during February, May and September. I have also observed what is presumably courtship behaviour in April and October. This involved frantic tail wagging, the male pursuing the female, mounting her and rubbing and twitching his body along hers. Copulation can apparently last for many hours as one pair were

observed mating late at night and were still mating the next morning.

The gravid females gain weight slowly and will feed to within four weeks of giving birth. It is quite apparent by October/November that the snakes are gravid, with a continuous body thickness right to the vent. The latest a gravid female has eaten before birth is 21 days, after which she refused mice offered. The gravid females tend to rest on the elevated platform beneath the UVA lamp more than usual. Data on three gravid females is set out in Table 1. All three sloughed in November 1999, gave birth in February 2000, and ate a mouse 3-4 weeks prior to parturition.

Data on the neonates is set out in Table 2. All of the neonates sloughed by 4 March 2000, with all sloughs being in one piece. Shortly after birth they all displayed the typical posture of the genus when disturbed. The neonates are all alive.

REFERENCES

Longmore, R 1986. Atlas of elapid snakes of Australia. Australian flora and fauna series number 7. AGPS Canberra.Page 63.

Shine, R 1983. Arboreality in snakes; Ecology of the Australian Elapid Genus *Hoplocephalus*. Copeia, 1983(I):198-205.

Shine, R. 1991. Australian Snakes A Natural History. Reed Books, Balgowlah. Page 210

TABLE 1: Parturition and other data on three captive females.

	Snake 1	Snake 2	Snake 3
Total length	695mm	730mm	695mm
Mass Date Last fed	107g 26 January 2000 3 January 2000	120g 14 February 2000 19 January 2000	
Mass Date Last fed	112g 13 February 2000 31 January 2000	122g 21 February 2000	90g 14 February 2000 19 January 2000
Date gave birth	21 February 2000	22 February 2000	Between 22 Feb. 2000 & 2 March 2000
No.of young	6	4	3
Cage temperature During parturition	26°C at 07.20hours	25°C at 04.25hours	
Temp. & humidity outside cage	23°C 56%		
Female mass after Parturition	64g	76g	54g
Total mass of.young	35g	29g	21g
-Mass loss of female post parturition	13g	17g	15g
Relative Clutch Mass (RCM) 1	0.75	0.60	0.66
Relative Clutch Mass (RCM) 2	0.54	0.38	0.38

Note: RCM1 (Maternal mass loss divided by maternal mass after birth).
RCM2 (litter mass divided by maternal mass after birth).

Table 2: Neonate data at birth

Female No.	Neonate No.	Time of Birth	SVL (mm)	Mass (g)
1	1	Before 07.00	210	7
	2	Before 07.00	220	5
	3	07.25	200	5
	4	08.10	215	6
	5	Between 08.10 and 09.10	215	6
	6	As for 5	215	6
2	1	Before 04.25	230	8
	2	Before 04.25	230	7
	3	06.19	230	8
	4	08.05	230	6
3	1	Not known	230	6
	2	Not known	220	8
	3	Not known	230	7

NOTES ON THE SOUTHERN LINED, OR GRASSLANDS EARLESS DRAGON, *TYMPANOCRYPTIS LINEATA PINGUICOLLA*, IN CAPTIVITY.

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In 1967 a small, road-killed dragon lizard from west of Melbourne was lodged with the Museum of Victoria. Despite numerous reported sightings since then, followed up by field work, this specimen remains the last authenticated record of the Southern Lined, or Grasslands Earless Dragon, *Tympanocryptis lineata pinguicolla*, from Victoria. The common name of Grasslands Earless Dragon seems preferable to Southern Lined Earless Dragon, to avoid confusion with *T. lineata lineata*, which occurs in the Victorian mallee (Cogger 2000). However, a recent paper elevates *T. lineata pinguicolla* to full species status (Smith *et al.*, 1999). There is no reason to suspect that this recommendation will not be widely accepted, and the remainder of this paper will refer to the full species.

It is quite possible that *T. pinguicolla* is extinct in Victoria, as it has not been positively identified since 1967 and its state listing is Critically Endangered (DNRE, 1999). It still occurs in areas around Cooma in New South Wales, and in the Australian Capital Territory (L. Nelson pers.comm).

There are also two records, considered to be *T. pinguicolla*, in the Queensland Museum. One from Bongeen, near Oakey (24° 34'S, 151° 27'E) and another from 30km south of Oakey (27° 39'S , 151° 36'E) and registered on 24 January 1979 (S. Wilson, pers. comm). While these Queensland records appear outside the known distribution for *T pinguicolla*, it is worth noting that the Olive Legless Lizard (*Delma inornata*) and the skink *Carlia tetradactyla*, both essentially southern grassy woodland reptiles, reach the northern limit of their range in similar habitat, in this area of southern Queensland (Cogger 2000).

On 8 March 1996, Melbourne Zoo received two immature *T. pinguicolla* from the Wildlife Research Unit. of the ACT Parks & Conservation Service. Both lizards had been caught at Woden, one on 26 April 1996 and the other on 11 May 1997.

Their dimensions on arrival were:

Specimen # 1	
Weight	4.3g.
Snout-vent length	52.0mm.
Total length	131.0mm.
Specimen # 2	
Weight	4.0g.
Snout-vent length	44.0mm.
Total length	107.0mm.

Both lizards were housed in an off-display area in the Reptile House in an enclosure measuring 600 x 450 x 350mm. This was constructed of plywood, with a glass front. Ambient temperatures inside the enclosure varied over the year, from 16°C - 35°C (March 1996) to 16.5°C - 19°C (July 1996).

It was suspected that both lizards were males, due to antagonistic behaviour between the dragons. This was confirmed on 8 October 1996, when hemipenes were everted on both animals. Sexual dimorphism is obvious in mature specimens of *T. lineata lineata* (Greer, 1989).

On 25 October 1996 both lizards were transferred to a larger outside enclosure which measured 1200 x 800 x 830mm and constructed of plywood. The floor had drainage holes and was covered with a substrate of palm peat and sand. It also contained two large grass tussocks and a surface layer of coconut fibre. The dragons shared the enclosure with Striped Legless Lizards, *Delma impar*, and readily accepted small grasshoppers and crickets, maggots, small mealworms, houseflies, blowflies and, when available, silk worm larvae.

Three months later in January 1997, the two lizards were placed in an indoor, grasslands display in the Reptile House. This is a glass case, measuring 920 x 370 x 410mm, featuring a concave diorama background depicting native grasslands west of Melbourne (Banks et.al., 1999). The substrate is a mixture of palm peat and sand, with basalt rocks and Kangaroo Grass (Themeda triandra) tussocks. Heating is provided by two, low voltage down lights and there is a 430mm overhead ultraviolet fluorescent. The dragons adjusted well to this environment and, together with a group of D. impar, displayed themselves, often basking on top of the rocks and tussocks, where temperatures reached 35°C.

The two dragons were separated on 16 February 1997 due to aggressive behaviour towards each other, one being transferred back to the outdoor enclosure. The dragon still on display was observed being aggressive toward a *D. impar* on 4 May 1997, with the diary notes for the day reading "territory defended against *D. impar*, which crossed the *Tympanocryptis* basking rock. Puffed up and aggressive" (Banks et.al., 1999; T. Hawkes, pers. comm).

The condition of dragon # 1. had deteriorated significantly by July 1999 and its last recorded weight was 6.40g.

The remaining dragon is still on display in the grasslands exhibit and appears to be in excellent condition. When last measured on 21 January 2000, it weighed 5.90g and had lengths of 50mm snout-vent and 120mm total. The conservation status of this species, including its potential for further decline in the wild, suggests that *T. pinguicolla* is a candidate for a captive management program. Given its public display value, it could also assist in increasing community awareness of threatened grasslands and their herpetofauna.

ACKNOWLEDGEMENTS

Jon Birkett and Matt Vincent, in the Herp Section at Melbourne Zoo, provided information on the management of the lizards, and Chris Banks reviewed the manuscript.

Steve Wilson (Queensland Museum), Nick Clemman (Victorian Department of Natural Resources & Environment) assisted with details of the Queensland and Victorian records respectively.

REFERENCES

Banks, C.B., Hawkes, T., Birkett, J. & M. Vincent 1999. Captive management and breeding of the Striped Legless Lizard, *Delma impar*, at Melbourne Zoo. Herpetofauna. 29(2)

DNRE 1999. *Threatened Fauna in Victoria.* Department of Natural Resources & Environment, Melbourne.

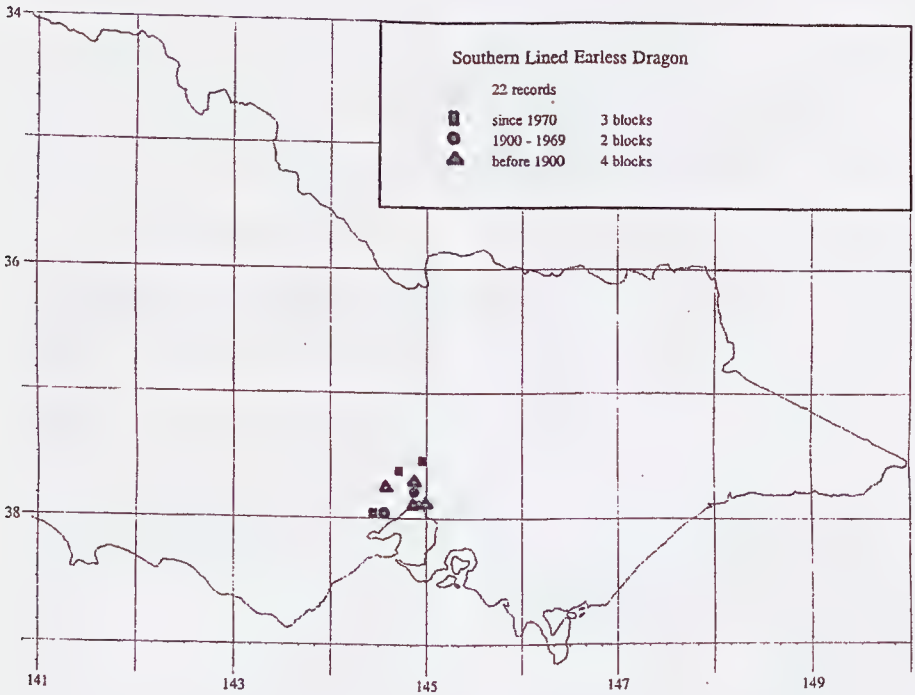
Brereton, R. and Backhouse, G. 1993. Southern Lined Earless Dragon *Tympanocryptis lineata pinguicolla* Action Statement No 35 DNRE.

Greer, A.E. 1989. *The Biology and Evolution of Australian Lizards.* Surrey Beatty & Sons Pty. Ltd, Chipping Norton.

Smith, W.J.S., Osborne, W.S., Donnellan. S.C. & P.D. Cooper 1999. The systematic status of earless dragon lizards, *Tympanocryptis* (Reptilia: Agamidae) in southeastern Australia. *Aust. J Zool.* 47: 551-64.

Cogger H. G. 2000. Reptiles and Amphibians of Australia. Reed New Holland. Sydney

Figure 1 Map showing records for the Grasslands Earless Dragon *Tympanocryptis pinguicolla* in Victoria. (Records since 1970 are possible sightings only)



Source: Atlas of Victorian Wildlife.

RESULTS OF A SURVEY OF THE REPTILES OF KARTE & PEEBINGA CONSERVATION PARKS, IN SOUTH AUSTRALIA'S MURRAY MALLEE

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INTRODUCTION

At a regional level the reptile species that occur in South Australia's Murray Mallee have been relatively well documented. Numerous species from the northwest edge of Billiatt Conservation Park were collected between 1974 and 1976, during a 3 year study of Mallee Dragons, *Ctenophorus fordi* (Baverstock, 1978). The South Australian Herpetology Group conducted short field trips to Billiatt CP in 1978 and in 1987 (White 1978, Armstrong 1987). In 1991 the then South Australian Department of Environment and Natural Resources conducted a regional biological survey of the Murray Mallee in SA, that included a single survey site at each of Karte and Peebinga Conservation Parks (unpublished). Nevertheless, on a Park by Park basis the reptile fauna had not been documented. In particular, the smaller Conservation Parks of Karte (3565 ha.) and Peebinga (3371 ha.) (Fig. 1) had only a handful of species formally recorded from within their boundaries.

This indicated that the smaller Mallee Conservation Parks were in need of greater scrutiny from field herpetologists. In particular, populations of vulnerable reptile species that may have become isolated due to habitat fragmentation needed to be identified to highlight the need for appropriate management strategies that could ensure the integrity of the disjunct ecosystems in which they survive.

Two reptile species that occur in the Murray Mallee are of specific conservation importance. They are the eastern Australian population of the Bardick, *Echiopsis curta* and the Mallee Worm-lizard, *Aprasia aurita*. They have been listed as vulnerable and endangered, respectively, in "*The Action Plan for Australian Reptiles*" (Cogger *et al*, 1993) and both have been recorded from Mallee habitats not far from Karte and Peebinga, although the Mallee Worm-lizard has not been recorded from South Australia.

Figure 1. Peebinga and Karte Conservation Parks

MATERIALS & METHODS

Eight short field trips, of 2-4 days duration, were made to Karte and Peebinga on the following dates; 23-26/12/94, 1-2/1/95, 8-9/1/95, 14-15/1/95, 26-28/1/95, 14-16/4/95, 7-10/10/95 and 8-10/12/95. This totalled 14 nights and 23 days in the field.

The survey strategy involved the selection of a primary survey site and four secondary survey sites in both Karte and Peebinga CP. Each primary survey site was approximately 250m x 250m in size and contained two 45m pit fall lines. Each primary site was also intensively searched using opportunistic methods. The four secondary sites for each Park were located near or adjacent to Park boundaries and were sampled less intensively using a pit fall and active search combination, or active search methods alone. The secondary sites provided additional data and a more comprehensive cover of each of the Parks. Observations made whilst travelling between sites were also recorded. Even so, only a relatively small percentage of each Park was covered and most effort was concentrated on accessible areas close to boundary and access tracks. Observations from roadside vegetation and rail line reserves adjoining the respective Parks are also included in the data. Due to the short duration of the trips, pit falling was not performed extensively and a total number of 280 pit nights were ultimately achieved.

The primary survey site in each Park was selected according to ease of vehicle access and were similar to each other in general habitat structure. Hence, both were on relatively level ground away from tall dunes and represented fairly typical open mallee woodland with a relatively dense ground cover of *Triodia*. This particular habitat type was considered to potentially contain the greatest diversity and concentration of reptiles and provided adequate opportunity for the employment of active search methods. However, as Karte CP consists predominantly of tall dunes the Karte primary site was not representative of the Park's general topography.

The secondary sites incorporated areas similar to the primary sites as well as areas containing sand dunes and different vegetation communities including those dominated by *Acacia* and/or *Melaleuca* species. The total data obtained from the primary and secondary sites and from incidental observations must therefore be considered before drawing any conclusions on the general abundance of reptile species and the extent of their distribution within the general areas of these Conservation Parks. Voucher specimens representative of most species were lodged with the South Australian Museum. The species for which no voucher specimen was collected were *Pogona vitticeps, Tiliqua occipitalis, Tiliqua rugosa* and *Varanus gouldii*.

RESULTS

A total of 389 individual sightings were recorded during the survey (Table 1). Survey effort was not consistent throughout the year or across the survey sites. Therefore, only a general indication of relative species abundance can be obtained from the data. The data should be interpreted, bearing in mind each species' habit and the methods used to detect their presence. For this reason, in Table 1, the number of individuals of each species recorded in each Park has been grouped according to the three major detection methods employed i.e:

1) ***Obs.*** - casual observation including spotlighting [43% of records (42% at Karte & 45% at Peebinga)]

2) ***Uncov***. – active search involving some habitat disturbance [37% of records (33% at Karte & 44% at Peebinga)]

3) ***Pitfall*** - pitfall trap lines [19% of records (25% at Karte & 10% at Peebinga)].

In general, reptile species detected most often and at several locations are probably common and widely distributed. Species recorded only once or twice or at a single location either possess a very cryptic habit or should be considered uncommon or restricted in distribution within the Park.

As a result of this survey the number of recorded species is now 22 at Karte CP and 24 at Peebinga CP (Table 2). However, only 17 (57%) of recorded species have been recorded from both Parks. Four species, *Ctenophorus fordi, Menetia greyii, Morethia obscura* and *Tiliqua rugosa* were commonly detected and appeared widespread throughout both Parks. Together they comprised some 53% of all sightings. *Lerista bougainvillii, Pogona vitticeps* and *Delma australis* together comprised a further 22% of all records but, although present at both Karte and Peebinga these species appeared to be more abundant at Karte. Conversely, *Hemiergis millewae* (4% of all records) was frequently recorded at Peebinga but was not detected at Karte.

Twenty one species comprised the remaining 21% of all records. These included many cryptic, fossorial or nocturnal species that are notoriously difficult to detect. *Amphibolurus norrisi, Christinus marmoratus, Nephrurus milii, Ctenotus uber* and *Ramphotyphlops bituberculatus* were recorded at Karte but not Peebinga. A further six species, *Amphibolurus nobbi, Ctenotus brachyonyx, Lerista punctatovittata, Delma butleri, Pygopus lepidopodus* and *Echiopsis curta* have been recorded from Peebinga but not from Karte.

The five most frequently encountered species at Karte CP were *Morethia obscura , Delma australis, Ctenophorus fordi, Tiliqua rugosa* and *Lerista bougainvillii*, together representing 60% of records for the Park. The five most frequently encountered species at Peebinga CP were *Morethia obscura, Ctenophorus fordi, Tiliqua rugosa, Hemiergis millewae* and *Menetia greyii*, together representing 61.5% of records for the Park.

Species diversity was greater at the Peebinga primary site (n=19) than at the Karte primary site (n=15). This is despite the fact that greater search effort (note the higher number of sightings at Karte) was directed to Karte after locating *Echiopsis curta* at Peebinga. The average number of species detected at secondary sites was lower than at the primary sites (6.25 at Peebinga and 7.25 at Karte), reflecting the reduced search effort at secondary sites.

DISCUSSION

Rare Species

During the course of the survey an attempt was made to meet the dual objectives of obtaining a complete list of species occurring at each Park and locating the two potentially vulnerable Mallee reptile species; the Bardick, *Echiopsis curta* (east Australian population) and the Mallee Worm-lizard, *Aprasia aurita*. One Bardick was located at Peebinga CP. It was raked from a damp triodia bush on a very warm, humid and overcast day in late January. This specimen was only the fifth Bardick to be collected from eastern South Australia. After locating one individual at Peebinga, the active search effort directed toward Karte CP was increased but this was without success. The Bardick has now been recorded from three separate conservation parks in SA's Murray Mallee in recent times. A specimen was collected from the nearby Billiatt CP in 1972 and another was taken at Danggali C P in 1977 (Morley and Morley, 1984).

The Mallee Worm-lizard was not located during the survey and has never been recorded from South Australia. It appears to be restricted to Victoria's Mallee Conservation Parks. The closest, Wyperfield, is approximately 100 km southeast of Peebinga.

Comparison with nearby Billiatt Conservation Park

Of the combined total of 32 reptile species now recorded from the region encompassing Billiatt, Karte and Peebinga Conservation Parks, 17 (52%) have been recorded at all three Parks (Table 2). This is not surprising considering the close proximity of Karte CP and Peebinga CP to the much larger Billiatt CP and the general similarity in habitat within each of these Parks, i.e. open mallee woodland.

Eight species have been recorded at only two of the three Parks. Six species have so far been recorded at only one of the three Parks (2 from Karte only, 1 from Peebinga only and

Table1; Individual records by species and detection method for each CP.

	No. Recorded at Karte CP				No. Recorded at Peebinga CP			
SPECIES	**Obs.**	**Uncov.**	**Pitfall**	**Total**	**Obs.**	**Uncov.**	**Pitfall**	**Total**
REPTILES (n=30)								
Amphibolurus nobbi	-	-	-	0	6	1	-	7
Amphibolurus norrisi	3	-	-	3	-	-	-	0
Ctenophorus fordi	16	1	16	33	19	1	4	24
Ctenophorus pictus	7	1	1	9	5	-	-	5
Pogona vitticeps	16	-	1	17	2	-	-	2
Christinus marmoratus	-	3	-	3	-	-	-	0
Diplodactylus damaeus	-	-	1	1	3	-	3	6
Diplodactylus vittatus	-	-	1	1	1	-	1	2
Nephrurus milii	-	-	1	1	-	-	-	0
Aprasia inaurita	-	1	2	3	-	1	1	2
Delma australis	-	33	3	36	-	5	-	5
Delma butleri	-	-	-	0	-	1	-	1
Lialis burtonis	-	2	-	2	1	5	1	7
Pygopus lepidodopus	-	-	-	0	-	-	-	*
Ctenotus brachyonyx	-	-	-	0	-	4	1	5
Ctenotus uber	1	-	1	2	-	-	-	0
Egernia inornata	-	1	-	1	2	1	-	3
Hemiergis millewae	-	-	-	0	1	15	-	16
Lerista bougainvillii	-	13	10	23	-	4	-	4
Lerista punctatovittata	-	-	-	0	-	2	-	2
Menetia greyii	4	8	8	20	5	11	-	16
Morethia obscura	33	8	15	56	11	9	4	24
Tiliqua occipitalis	-	-	-	*	1	-	-	1
Tiliqua rugosa	17	8	-	25	6	2	-	8
Varanus gouldii	4	-	-	4	tracks	-	-	tracks
Echiopsis curta	-	-	-	0	-	1	-	1
Pseudonaja textilis	2	-	-	2	2	-	-	2
Ramphotyphlops australis	-	2	-	2	-	1	-	1
Ramphotyphlops bituberculatus	-	1	-	1	-	-	-	0
TOTAL REPTILES	**101**	**82**	**61**	**244**	**66**	**64**	**15**	**145**

* Species recorded during previous Dept. Environment &Natural Resources survey.

3 from Billiatt only). All of the 6 species recorded at only one Park are common species that occur widely throughout South Australia and to date may well have merely gone undetected during surveys.

Aerial photographs reveal that there is a continuous cover of remnant mallee vegetation connecting Peebinga CP with Billiatt CP. However, Karte and the small amount of adjoining privately held remnant mallee is completely surrounded by cleared farmland with only thin stretches of discontinuous and degraded rail line and roadside vegetation running northeast to Peebinga and northwest to Billiatt. Despite the greater isolation of Karte CP both Karte and Peebinga share comparable numbers of species with Billiatt ie. 20 (69% similarity) & 23 (79% similarity) respectively.

Karte Conservation Park - a special case?

The possible absence of several species (*E. curta, L. punctatovittata, H. millewae, A. nobbi* and *C. brachyonyx*) from Karte CP is of interest. All have been recorded from both Billiatt and Peebinga Conservation Parks. Potential reasons for the apparent absence include - incomplete sampling, lack of suitable habitat and changes to the Park's vegetation due to frequent bush fires. Unfortunately, the lack of historical records precludes confirmation of the loss of any of these species from the Park. Nevertheless, Karte's isolation from other patches of remnant Mallee and the resultant inability of many mallee dependent species to naturally recolonise the Park from adjacent areas has implications for the Park's management.

During the survey one of the secondary sampling sites for Karte was located at the Karte dump. The dump is situated amongst degraded roadside mallee habitat near to Karte but is separated from the Park by cleared paddocks. The six species recorded at this site (i.e. *Christinus marmoratus, Nephrurus milii, Delma australis, Morethia obscura, Tiliqua rugosa* and *Pseudonaja textilis*) provide some indication of the reptile species that can survive in degraded mallee habitats. Apart from these six species and *Pogona vitticeps*, which is frequently observed along roadsides throughout much of rural SA (pers. obs.), the reptiles at Karte appear essentially isolated from other populations.

CONCLUSION

The reptile species occurring at Karte and Peebinga Conservation Parks are generally typical for the Murray Mallee region and consequently both Parks have many species in common with nearby Billiatt Conservation Park. The species lists provided in this report are undoubtedly still incomplete but for the first time demonstrate the diverse range of reptile species that inhabit each Park. They also provide a firm basis for further survey and monitoring work in the area. Peebinga CP is now a proven additional locality for the potentially vulnerable Bardick, *Echiopsis curta*. The inability to detect several species, including the Bardick at Karte CP in conjunction with the Park's isolation from other areas of remnant mallee is of some concern and requires further investigation. In particular, periodic surveys conducted over the next decade or two are required to determine whether Karte's isolation is contributing to a progressive decline in the diversity of reptile species within the Park.

ACKNOWLEDGEMENTS

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REFERENCES

Armstrong, G. 1987. Field Trip Report - Billiatt Conservation Park. *SA Herpetology Group Newsletter No.60*. 2-4.

Baverstock, P.R. 1978. A Three Year Study of the Mammals and Lizards of Billiatt Conservation Park in the Murray Mallee, South Australia. *SA Naturalists*, 53(4). 52-58.

Table 2; Recorded species from Karte, Peebinga and Billiatt CPs.

SPECIES	Karte	Peebinga	Billiatt
Amphibolurus nobbi		X	X
Amphibolurus norrisi	X		X
Ctenophorus fordi	X	X	X
Ctenophorus pictus	X	X	X
Pogona vitticeps	X	X	X
Christinus marmoratus	X		
Diplodactylus damaeus	X	X	X
Diplodactylus vittatus	X	X	X
Nephrurus milii	X		X
Aprasia inaurita	X	X	X
Aprasia striolata			X
Delma australis	X	X	X
Delma butleri		X	X
Lialis burtonis	X	X	X
Pygopus lepidodopus		X	
Ctenotus brachyonyx		X	X
Ctenotus brooksi			X
Ctenotus uber	X		X
Egernia inornata	X	X	X
Egernia striolata			X
Hemiergis millewae		X	X
Lerista bougainvillii	X	X	X
Lerista punctatovittata		X	X
Menetia greyii	X	X	X
Morethia obscura	X	X	X
Tiliqua occipitalis	X	X	X
Tiliqua rugosa	X	X	X
Varanus gouldii	X	X	X
Echiopsis curta		X	X
Pseudonaja textilis	X	X	X
Ramphotyphlops australis	X	X	X
Ramphotyphlops bituberculatus	X		
Species No = 32	22	24	29

Cogger, H.G., Cameron, E.E., Sadlier, R.A. and Eggler, P. (1993). The Action Plan for Australian Reptiles, *Australian Nature Conservation Agency, Canberra, ACT.* 147-149.

Morley, T.P. and Morley, P.T. (1984). An Inventory of the Reptiles of Danggali Conservation Park, *Herpetofauna*, 15(1&2) 32-36.

White, J. (1978). Field Trip Report - Billiatt Conservation Park. *S.A. Herpetology Group Newsletter*, 1(2). 7-9.

OBSERVATIONS ON THE EFFECTS OF FIRE ON THE HIP-POCKET FROG, *ASSA DARLINGTONI*

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The hip-pocket frog, *Assa darlingtoni*, is a small Myobatrachid frog inhabiting montane areas of northern New South Wales and southern Queensland (Cogger, 1995). The southern limit for this species is the Dorrigo area to the west of Coffs Harbour, where several populations are known (Lemckert and Morse, 1999). This frog is restricted to areas of wet sclerophyll forest and rainforest where it lives amongst ground cover such as thick leaf litter and or rocky scree (Barker et al, 1995; Lemckert and Morse, 1999). It is a terrestrial breeder and has intensive parental care (Ehmann and Swan, 1985).

The hip-pocket frog is listed as Vulnerable under the New South Wales Threatened Species Act (1995) and so is considered to be conservation dependent for its long-term survival, but it is unclear if and how this species is affected by human induced disturbances. As noted by Ehmann (1997), natural fire is likely to be rare within forests inhabited by this frog. However, fires lit by humans can damage the margins of moist forests even in wetter years and may penetrate or be lit deep within areas of moist forest in dry years. The impacts of such fire have not been reported. I present here observations indicating the hip-pocket frog is sensitive to fire within its habitat.

In 1993 and 1994 searches for hip-pocket frogs were undertaken in Wild Cattle Creek State Forest, 30 kilometres north of Dorrigo, as part of an Environmental Impact Assessment (see Lemckert and Morse, 1999). Six populations were located and the number of calling males present in each was assessed through a three to five minute listening period every 50 metres along a transect running through suitable habitat. This search was repeated at each site on a subsequent night.

In 1995, northern NSW was in a drought and in November a major uncontrolled fire burnt a large area of Wild Cattle Creek State Forest, north of Dorrigo. A number of areas of forest were also subject to controlled burns to combat this fire. Two of the recorded sites inhabited by the hip-pocket frog were affected by fire.

The first is in the northern part of Wild Cattle Creek SF (AMG 475100 6668550) in an area of wet sclerophyll forest dominated by blackbutt (*Eucalyptus pilularis*). A population of 50 to 70 male hip-pocket frogs was counted along 150m transect in 1993. In the 1995 fire, this site suffered total leaf litter, understorey and crown loss. The nearest area of unburnt forest was over 1 kilometre distant. This site has been monitored yearly site since the fire (until February 1999), but no calls have been heard even though a new leaf litter layer, understorey and canopy has formed.

The second site is in Black Bull Flora Reserve and its immediate surrounds (AMG 473250 6663300), five and a half kilometres to the south. Counts in 1993/94 indicated that a population of at least 500 male hip-pocket frogs was present within an area of blackbutt dominated wet sclerophyll forest adjacent to a 500m length of road. In 1995 this site was subject to a controlled back-burn that resulted in an 80% loss of leaf litter cover, scorching of tree trunks up to a metre above the ground and the death of foliage at 2-3 metres above the ground. However, there was no crown loss and approximately 20% of the forest area remained unburnt as a series of patches up to five metres in diameter. The

nearest area of unburnt forest was 400-500 metres away. No hip-pocket frogs were heard calling at this site in 1996, one year after the fire. In 1997 between three and five males were heard calling at this site and by February 1999 numbers had increased to approximately 50 frogs.

A population unaffected by fire was monitored in Bielsdown State Forest, 15 kilometres further south (AMG 474800 6648700). In 1994, approximately 40 calling males were located over a 150 metre long transect in a patch of cool temperate rainforest. The number of males has been recorded at the same times in 1996, 1997 and 1999 that the other sites were visited and 40, 30 and 40 males respectively were recorded calling.

These are not extensive experimental observations, but they do suggest that the hip-pocket frog is relatively sensitive to fire. This includes not only severe uncontrolled forest fires, but also lower intensity controlled fires. The hip-pocket frog lives in forests that are rarely or never burnt naturally. However, dry forests in areas of state forest also used for cattle grazing (e.g., the western part of the Dorrigo area) are burnt on almost a yearly basis by graziers to assist in fire suppression and to encourage the growth of grass (Pers. Obs.). These fires burn into the edges of the moist forest during years of average rainfall and so affect the edges of populations of this frog. However during years of below average rainfall such as in 1995, these fires can enter into and impact upon large areas of moist forest. The yearly burning by graziers will almost ensure that such fires will burn deeply into moist forests whenever the conditions are suitable to do so, rather than on a random occasion, and so fire is likely to have become a significant problem in this "unnatural" situation.

The data collected so far indicates that fire can have a significant impact on the hip-pocket frog, but the best approach to fire management to protect this species is unclear. Additional research and continued monitoring is required to ensure that correct fire management decisions can be made in the future.

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REFERENCES

Barker, J., Grigg, G. C. and Tyler, M. J., 1995. A Field Guide to Australian Frogs. Rigby, Adelaide.

Cogger, H. G., 1992. Reptiles and Amphibians of Australia (Revised Edition). Reed. Sydney.

Ehmann, H. 1997. Threatened frogs of New South Wales: Habitats, status and conservation. Frog and Tadpole Study Group of New South Wales, Sydney South.

Ehmann, H. and Swan, G. 1985. "Reproduction and development in the marsupial frog, *Assa darlingtoni* (Leptodactylidae, Anura)." pp 279-285 in G. C. Grigg, R. Shine and H. F. W. Ehmann (eds.). The Biology of Australasian Frogs and Reptiles. Surrey Beatty and Sons with R. Zool. Soc. N.S.W., Sydney.

Lemckert, F. L. and Morse, R. 1999. "Frogs in the timber production forests of the Dorrigo Escarpment in northern New South Wales: An inventory of species present and the conservation of threatened species". pp. 72-80. in Alastair Campbell (ed.). Declines and Disappearances of Australian Frogs. Environment Australia, Canberra.

Tyler, M. J., (ed.) 1992. Encyclopedia of Australian Animals: Frogs. Collins, Angus and Robertson, Sydney.

IT'S A SMALL WORLD

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Not only is the world becoming a smaller place for it's human inhabitants, but also it would seem for some of it's reptile inhabitants.

An Asian House gecko, *Hemidactylus frenatus* (Figures 1 and 2) was discovered in February, 1996 living on a building in an industrial estate of Murwillumbah on the NSW far North Coast (28° 20', 153° 25').

A common arboreal species found throughout much of the Asia - Pacific region, it is probably an accidental introduction to Australia (Cogger, 1992; Wilson and Knowles,1992).

The distribution of *H.frenatus* in Australia can be roughly depicted by two narrow discontinuous strips, one down the far north east coast of Queensland to Cairns and the other from Darwin south along the Stuart Highway (Cogger, 1992) to Renner Springs (Fyfe, 1981; Wilson and Knowles, 1992).

Couper (1997 pers. comm.) states the species is now common in Brisbane and has been present there for "the best part of a decade." Greer (1989, p. 66) points to several studies which show that *H. frenatus* has the ability to displace other geckonnids with a penchant for manmade habitat. In Australia at least, this species appears to be an obligate "human cohabitant" (Cogger, 1992; Wilson and Knowles, 1992) and therefore may not pose a threat to endemic species with similar preferences, other than on a localised level.

The specimen at Murwillumbah appeared to be alone but it is interesting to speculate on how far south this species will penetrate (analogous to *Bufo marinus* migration). Assuming this individual was a stow-away on south bound freight it is not the first and almost certainly will not be the last time this species will turn up in other regions of Australia.

REFERENCES

Cogger, H, G. 1992. Reptiles and Amphibians of Australia, 5th Edition. Reed Books, Chatswood.

Greer, A. E. 1989. The Biology and Evolution of Australian Lizards. Surrey Beatty & Sons, Chipping Norton.

Wilson. Stephen K. & Knowles, David G. 1992. Australia's Reptiles. Cornstalk Publishing.

Fyfe 1981. Range extension for *Hemidactylus frenatus*, the Asian house gecko.Herpetofauna 13 (1):33.

Figures 1 and 2: *Hemidactylus frenatus* found at Murwillumbah.

NOTES ON HERPETOFAUNA OF BENDALONG (SOUTH COAST OF NSW), WITH REPRODUCTIVE DATA ON ELAPID SNAKES AND A RANGE EXTENSION FOR *HEMIASPIS SIGNATA*

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INTRODUCTION

Bendalong is located on Red Head (35°15'S, 150°32'E) approximately 40km south of Nowra on the South Coast of New South Wales. Manyana is a similar community a few kilometres south-west, adjacent to Lake Conjola, while North Bendalong is an outpost separated by just a narrow beach and a headland. A variety of habitats occur in the area: paperbark swamps and mangroves, ranging through wet and dry sclerophyll forest dominated by eucalypts (dry on the south side of Bendalong, wetter in gullies and less exposed slopes along the road out to the highway, adjoining the recently declared Conjola National Park) to heath (on laterite areas to the west, and near Manyana) and partially vegetated dunes (along the south-facing Back Beach). The original tall trees of Red Head, reputedly including red cedars, were clear-cut early in the 20th century, and the headland is now an area of *Casuarina- Banksia* secondary woodland (including the camping area referred to below), surrounded by intertidal rock platforms, cliffs and rocky beaches, the volcanic rock ranging from basalt-like to poorly consolidated deposits of ash and pumice.

Four species of amphibians, eight lizards, and seven snakes were recorded opportunistically during visits to Bendalong and Manyana between 1974 and 1997, mostly during January. The species are listed below with brief notes on abundance and habitat, and more detail on the elapid snakes, some of which were held in captivity to obtain data on reproduction and behaviour. No attempt has been made to fully survey herpetofauna of the area, so that objective estimates of abundance are not possible, but I state either an approximate number observed or use terms based on the 'time to locate first individual' criterion of Ehmann (1992; "abundant" = less than 1 hour, 'common' 1-25 hours, etc.). Taxonomy follows Cogger (1992) for frogs and lizards, Greer (1997) for snakes, and 'common' names are mostly from Ehmann (1992). The most significant results are data on variation and reproduction in a local population of *Drysdalia rhodogaster* (Mustard- bellied Snakes), and a southerly extension for the known geographic range of *Hemiaspis signata* (Marsh Snake).

HYLIDAE

Litoria aurea (Green and Golden Bell Frog) - formerly abundant (easily heard and seen by day) in a bullrush swamp with culvert under Maple St, Bendalong (near the north-facing Washerwoman's Beach) and adjacent wet sclerophyll forest; last seen January 1977.

Litoria dentata (Bleating Tree Frog) - one, active at night in camping area (*Banksia-Casuarina* woodland).

MYOBATRACHIDAE

Limnodynastes peronii (Brown-striped Frog) - one, active at night in camping area.

Pseudophryne bibronii (Brown Toadlet) - 5 or 6 located under rocks beside Maple St (uphill from *L. aurea* site). Apart from coastal platforms and laterite areas, only a few rocks are present and this is the only species observed utilising them as cover.

PYGOPODIDAE

Pygopus lepidopodus (Eastern Scaly-foot) - present but 'rare' (never found by active searching) in the Back Beach dune area, about 5 seen active or basking diurnally on or beside tracks. Open-topped burrows occupied by large mygalomorph spiders, representing a major food-source for *Pygopus* (Patchell and Shine 1986), are common in adjacent woodland areas. One large specimen, while held in the hand, voluntarily took and swallowed an adult *Lampropholis delicata*, which appears to be the only record of predation on a vertebrate by a pygopodid other than *Lialis*. The skink was killed by slow, powerful bites, and swallowed by use of the tongue.

AGAMIDAE

Amphibolurus muricatus (Jacky Dragon) - abundant, especially on Back Beach dunes and also common in casuarina woodland, eucalypt forest, and cliff-edges on headland.

SCINCIDAE

Ctenotus taeniolatus (Coppertail Skink) 'common' in and near Back Beach dunes, seen more frequently than *Pygopus* but much less than *Amphibolurus*.

Eulamprus quoyii (Golden Water-Skink) - locally common along creeks in eucalypt forest west of town.

Eulamprus tenuis (Bar-sided Skink) - one found dead in camping area (January 1979). Possibly transported accidentally from Sydney in camping gear, as some of our neighbours in camp were from Greenwich where this species commonly inhabits crevices in cliffs and rock walls (natural and artificial); but it also occurs in forests around Nowra and the Bega area, where it tends to be arboreal rather than saxicoline (pers. obs., Lunney and Barker 1986, Murphy and Daly 1998).

Lampropholis delicata (Dark-flecked Garden Skink) - abundant in all areas; most specimens with strong white lateral stripe (in the Sydney area, this feature is usually present only in *L. guichenoti*).

Lampropholis guichenoti (Pale-flecked Garden Skink) - one typically-marked individual of this species was found in January 1979 near the boat ramp on the most easterly north-facing beach. Given the amount of trailer traffic to this site, it may have been introduced from elsewhere.

Saproscincus mustelinus (Weasel Skink) - abundant in all areas.

Tiliqua scincoides (Common Bluetongue Skink) - sparse (about 4 seen) in open dry sclerophyll on southern side of town.

BOIDAE

Morelia spilota spilota (Diamond Python) - reported by locals in eucalypt forest and adjacent buildings, one adult from North Bendalong seen in captivity.

ELAPIDAE

Cryptophis nigrescens (Eastern Small-eyed Snake) - abundant in wet or dry eucalypt forest, usually inside or under rotten logs; more than once, an adult male and female were found together (as also seen in other parts of its range, and in other species of *Cryptophis* and *Parasuta*, pers. obs. and Turner 1998). One juvenile active at night in headland camping area. Ventral surface white, not yellow or reddish as in northern parts of its range. Scale-counts (ventrals, subcaudals): 177, 42; 168, 36 (sex unknown); 164, 33 (male); 164, 34 (female; snout-vent length 420, tail 65 mm; killed by a dog on 27/3, contained 5 near-term young, one with SVL 128, tail 22 mm).

Drysdalia rhodogaster (Mustard-bellied Snake) - abundant, present in most areas and habitats, seen either basking between 7 and 9am, or under cover at other times (sometimes inside hollow logs, but generally drier situations than *Cryptophis*). For a number of years from 1979, most individuals of this species (as well as numerous *Pseudechis* and the only *Hemiaspis*) were located in the ruins of a house in Ebby Ave (the most westerly building in Bendalong) which burnt down in the summer of 1977- 78, providing a clearing with abundant cover (roofing iron, planks, grass tussocks) on the edge of tall forest. Two or three gravid females were sometimes found sharing a refugium or basking site (e.g. in Table 1, S53 and S54, and S151 and S152, were using the same large uprooted stump in two different years), but not directly associated with males. There are few rocks in available habitats (sandy, clay or deep soil substrata), and captive specimens mostly avoided using rocks as cover.

Overall dorsal colour is grey, with varying amounts of reddish pigment which usually increases laterally. When examined closely, a pale grey ground colour is marked by fine black speckles on each scale, some forming distinct longitudinal series of which there are about 4 to a scale. Red pigment is usually absent from 1.5 rows on each side of the vertebral row, but present on the vertebral row itself, in which the scales may also have relatively distinct black tips. Red pigment is concentrated along the middle of each scale where present, while whitish upper and lower edges

form longitudinal lines laterally, especially on the anterior part of the body. Skin between the scales black. The common name suggested by Ehmann (1992) is appropriate: the venter is solid yellow, with darker and lighter flecks, in juveniles and some adults of both sexes (uncommon in females, seen in only one or two), or yellow, orange or pink with a mottled translucent median zone (usual in females, also one adult male); these could be referred to as 'hot English mustard' and 'seedy French' morphs. Nape collar yellow, usually defined anteriorly and posteriorly by black and sometimes containing a few black spots (useful for recognising individuals). Dark longitudinal facial stripe interrupted, usually not reaching front or rear edge of eye; upper lip grey, occiput blackish, breaking up in frontal region to grey snout flecked with black. Chin and throat pale yellow with grey edging on scales.

Sexual dimorphism in relative head size (Coventry and Rawlinson 1980) is distinct enough to reliably sex most adult *D. rhodogaster* on sight; females also tend to have somewhat higher ventral and lower subcaudal counts (in sexed individuals from Bendalong: males 131-145, 45-52; females 143-151, 40-48). Table 1 gives data for most of the individuals recorded in the field, and young born in captivity to females collected gravid (some of these data were used by Shine 1981). All adult females seen in January have been gravid (litter size ranged from 3 to 6, showing a weak correlation with maternal SVL; Fig. 1).

Hemiaspis signata (Marsh Snake) - one individual seen in the area, a gravid female caught on 10/1 /1980 (under tin at Ebby Ave) which gave birth to 5 apparently premature young on 8/3/80. Four died almost immediately after birth (the males with hemipenes everted), one lived until 20/3. The adult had a number of 'skin-worms' (parasites common in this and other frog-eating species, never observed in *D. rhodogaster*), and only very faint markings on the supralabials. This record represents a range extension, as Bendalong is about 20 km South-west of Vincentia, the most southerly locality for *H. signata* reported by Murphy (1997).

Pseudechis porphyriacus (Red-bellied Black Snake) - common at Ebby Ave, and numerous road-kills seen between Bendalong and Manyana (adjacent to eucalypt forest); also reported on headland. No individuals longer than about 1.5 m have been seen. One collected gravid on 22/1/79 gave birth to 11 young, 5 of them dead and either premature or showing abnormal development (reflected in proportions of tail length and umbilicus-vent distance to snout-vent length, Table 3). Other *P. porphyriacus* from Bendalong had the following scale-counts (V, Sc total, Sc single): 185, 52, 8 (sex not determined); 184, 56, 9 (m); 181, 56, 11 (f); while a female from near Pigeonhouse Mountain (which is about 20 km south-west, and visible from Back Beach and Manyana) had 183, 54, 25. Ventral and subcaudal scale-counts appear to be less variable in this population of *P. porphyriacus* (males 180-184, 56-58, n=8; females 177- 185, 53-56, n=6) than in the small elapids of the area.

Pseudonaja textilis (Eastern Brown Snake) - I have seen a photograph of a large Brown snake road-killed in Bendalong in 1972 or 1973 (Vermeesch family), but no other specimens from the area.

Pelamis platurus (Yellow-bellied Sea Snake) - none personally observed, but I have heard several first-hand reports of *Pelamis* washed up on Back Beach after storms.

Other species seen in the general area include several road-killed *Varanus varius* (Lace Monitors) on the Princes Highway near the Bendalong turnoff; and a large adult *Notechis scutatus* (Tiger Snake) and several *Egernia cunninghami* (Cunningham's Spiny- tailed Skinks) near the top of Pigeonhouse Mountain (35°21'S, 150°16'E).

ACKNOWLEDGEMENTS

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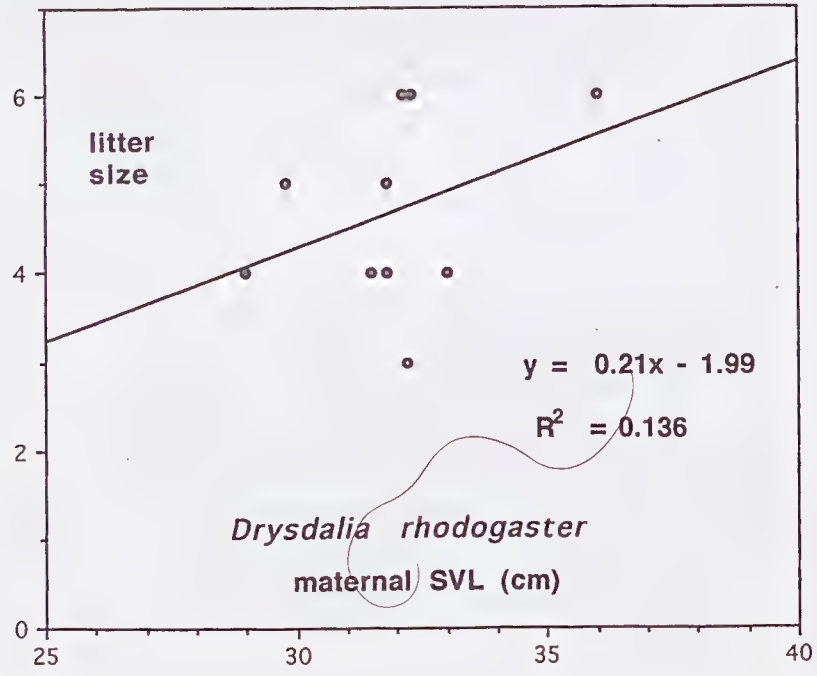
Table 1. Data on specimens of *Drysdalia rhodogaster* examined from Bendalong, NSW, and young of three litters (placed immediately below mother in table). S, record number; SVL, snout-vent length in mm; TL (in brackets as alternative to SVL, total length in mm; V, ventral count; Sc, subcaudal count.

S	SVL (TL)	tail %SVL	V	Sc	sex	no.of young	date caught	date born
53	(395)		143	44	f	6	24/1/79	
72	(152)		139	51	?			28/2
73	(146)		143	42	?			28/2
74	(148)		136	45	m			28/2
75	(150)		135	49	?			28/2
76	(141)		136	51	f			28/2
77	(150)		139	50	m			28/2
54	(395)		147	40	f	6	24/1/79	
119	355	25.4	141	50	m		8/1/80	
120	315	22.2	150	48	f	4	9/1/80	
133	103	24.3	134	51	m			26/3
134	115	21.7	131	48	m			26/3
135	123	18.7	144	41	f			26/3
136	116	21.2	139	49	?			26/3
122	290	24.1	151	48	f	4	16/1/80	
124	314	22.3	145	46	m		16/1/80	
126	330	21.2	149	48	f	4	21/1/80	
151	360	23.1	145	46	f	6	13/1/82	
152	322	22.6		46	f	3	13/1/82	
152A	239	25.1	136	48	m		13/1/82	
153	318	23.9	144	46	f	5	13/1/82	
154	318	22.0			f	4	15/1/82	
155	288	23.6	143	45	m		15/1/82	
159A	337	24.6	142	46	m		5/1/87	
160	298	22.8	140	43	f	5	15/1/87	
161a	117	23.2	139	49	?			16/2
161b	114	22.6			?			16/2
161c	113	23.0			?			16/2
161d	114	20.9			?			16/2
16le	115	23.0	146	48	?			16/2

Table 2. Data on specimens of *Hemiaspis signata* from Bendalong, NSW; one adult female and its young born in captivity on 8/3/80. Measurements taken at date of death.

H. signata	SVL (mm)	tail %SVL	Ventrals	S'caudals	Sex	Died
adult	380	18.4	159	42	f	
young: 1	92	18.5	151	36	f	8/3
2	91	17.6	150	33	f	8/3
3	80	22.5	145	41	m	8/3
4	85	21.2	144	41	m	8/3
5	102	21.6	158	43	?	20/3

Figure 1. Plot of litter size (number of young) against maternal snout-vent length (SVL, cm) for wild-caught *Drysdafia rhodogaster* from Bendalong, NSW (data in Table 1). SVL is estimated for two of the females (where only total length was recorded) based on mean relative tail length of others in the sample. Least-squares linear regression (Cricket Graph, Rafferty and Norling 1989) shows positive but weak dependence of litter size on maternal size.



REFERENCES

Coventry, A.J. & P.A. Rawlinson. 1980. Taxonomic revision of the elapid snake genus *Drysdalia* Worrell, 1961. Memoirs of the National Museum of Victoria 41: 65-79.

Ehmann, H. 1992. Encyclopaedia of Australian Animals. Reptiles. Angus and Robertson, Sydney. 495 pp.

Lunney, D. & J. Barker. 1986. Survey of reptiles and amphibians of the coastal forests near Bega, N.S.W. Australian Zoologist 22(3): 1-9.

Murphy, M.J. 1997. Records of the Marsh snake *Hemiaspis signata* near Nowra, NSW: a southern extension of the known range of the species. Herpetofauna 27(2): 33-34.

Murphy, M.J. & G. Daly. 1998. Survey of the reptiles and amphibians of the escarpment and riverine forests north west of Nowra, NSW. Herpetofauna 28(2): 16- 21.

Patchell, F.C. & R. Shine. 1986. Food habits and reproductive biology of the Australian legless lizards (Pygopodidae). Copeia 1986: 30-39.

Rafferty, J. & R. Norling. 1989. Cricket Graph. Cricket Software, Malvern, PA.

Shine, R. 1981. Venomous snakes in cold climates: ecology of the Australian genus *Drysdalia* (Serpentes: Elapidae). Copeia 1981: 14-25.

Turner, G. 1998. Evidence of diurnal mate-searching in male Little Whip Snakes, *Suta flagellum* (Elapidae). Herpetofauna 28(l): 46-50.

White, B.S., J.S. Keogh & R. Shine. 1995. Reproductive output in two species of small elapid snakes. Herpetofauna 25(2): 20-22.

Table 3. Scale-counts and measurements of an adult female *Pseudechis porphyriacus* (S52, total length 143 cm) and its eleven young. Abbreviations as in Table 1 except: Sc (no. single), total number of subcaudal scales and (in brackets) number of single anterior subcaudals; umb-V, distance between umbilicus and vent (mm).

S	Date born	SVL at birth (mm)	Tail, %SVL	SVL at 4/4/79	Sex	V	Sc (no. single)	umb-V, %SVL
52					f	180	53(6)	
60	2/2/79	165	18.8	—	f	181	56(9)	17.0
80	6/3	213	19.7	—	m	182	57(11)	15.5
80a	7/3	148	14.9	—	m	?	?	6.8
80b	7/3	140	24.3	—	m	?	?	12.9
84	22/3	225	9.3	—	m	180	57(11)	22.2
85	22/3	225	20.0	235	f	185	55(6)	15.5
86	22/3	225	19.1	230	m	184	58(10)	13.3
87	22/3	222	19.4	223	m	180	58(9)	14.4
88	22/3	220	18.2	225	f	177	54(7)	14.5
89	22/3	202	19.8	203	f	177	54(13)	17.3
90	22/3	223	17.9	225	m	184	57(15)	13.5

SOME HABITAT AND BEHAVIOUR OBSERVATIONS OF VARANIDS IN THE NORTHERN TERRITORY

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The top end of the Northern Territory has a rich diversity of lizards (Woinarski 1993), inhabiting a variety of habitats (Shine 1986, Wilson and Knowles 1988, Christian *et al.* 1996, Blamires and Nobbs 1999). In the woodland habitats, lizards face seasonal water shortages (Christian *et al.* 1995) and fire (Braithwait 1987) and many are forced into inactivity during the dry season (May to August) and dry-wet transition (September - October). Riparian inhabitants on the other hand, associate with permanent water and are able to maintain activity throughout the year (Christian *et al.* 1996), which may allow some an extended breeding period (Blamires 1999).

Monsoon forests line much of the top end shoreline, and the permanent thick vegetation would be expected to provide year round shelter. It may be expected that lizards move into them from adjacent woodland during the dry season. Documented here are some observations of seasonal habitat associations and behaviour of four species of varanid lizard (*Varanus* spp.), made over 21 months, while commuting between Berry Springs and Dundee Beach, Northern Territory (approximately 110 kms).

THE AREA

The observations were made along approximately 110km of road (approximately 65km unpaved) between Berry Springs (12° 46'S; 131° 02'E) and Dundee Beach (12° 43'S; 130° 20'E) (Figure 1). The area is mostly low-canopy woodland,, dominated by *Livistonia* and *Cycad* vegetation and termite mounds. There are numerous creeks and two major rivers: the Darwin River and Charlotte River. Approximately 13km from Dundee Beach is tropical monsoon forest, dominated by tall trees such as *Bombax* and *Alstonia*. The route was driven twice monthly for 21 months (March 1997 to December 1998).

OBSERVATIONS

Each time a varanid was sighted, I drove past it and stopped the vehicle approximately 50–100m further along the road. The lizard's position was determined by speedometer readings taken at the stopping point and again when arriving at Dundee Beach. The species of each varanid was identified visually. The habitat: woodland, riparian (if a creek or river was visible from the position where the lizard was seen), or monsoon forest was noted and the varanid was approached slowly to observe the response. Response was classed as either 1) "freezing" (lying, or sitting, on the spot without moving), 2) running into nearest grass/shrub, 3) running up a tree, 4) running into the water, or 5) running out of sight. The response recorded was the initial response, for example lizards that "froze", then fled on further approach were classified as "freezing".

Four species were seen over the study period, *Varanus panoptes, V. gouldii, V. scalaris* and *V. mertensi*. *Varanus panoptes* was identifiable visually from *V. gouldii* by size, ventral colouring and tail striping (as in Cogger 1992). The number of sightings for each month is shown in Table 1. *Varanus panoptes* was seen most frequently and throughout the year, while *V. gouldii* was rarely seen during the dry season (May to October). *Varanus mertensi* sightings were evenly distributed throughout the year but there were no sightings in May, June or September. There were only three *V. scalaris* observations throughout the period.

Varanus panoptes was seen in all habitats (woodland, riparian and monsoon forest)

They have also been seen on the beach and in the mangroves at Dundee Beach (Blamires and Nobbs 1999). *Varanus gouldii* was only seen in the woodland, while *V. mertensi* was only seen in riparian habitats. No *V. gouldii* were seen within a distance of 30km from Dundee Beach. Sightings of *V. scalaris* occurred once in the woodland and twice in the monsoon forest.

Behavioural responses to approach are shown in Table 2. There appeared to be some contrasting behaviours between the species. *Varanus panoptes* nearly always ran out of sight. The usual response was for the lizard to first stand upright on the hind legs and, if approached further, to run on two or four legs into the forest well beyond the roadside vegetation. Running to the nearest vegetation and running into a roadside drain was also observed in this species, but less frequently. *Varanus gouldii* displayed a variety of responses but never ran out of sight. The most common response was to sprint to the nearest clump of grass or small shrub and not move. This species was twice observed to "freeze" when approached, and on three occasions run up a tree. On one occasion *V. gouldii* was observed to run into a roadside drain and remain in the water for the period of time it was observed. Every *Varanus scalaris* was observed to run up a tree. *Varanus mertensi* ran into the water on all, except for two, approaches. On these occasions the direction of approach prevented escape to the water and the "freeze" response was adopted.

DISCUSSION

Varanus panoptes was the most frequently seen and had the widest habitat distribution of the varanids observed. Large varanids inhabit large areas (Auffenburg 1981 , King *et al.* 1989) and *V panoptes* is the largest of the varanids observed (Shine 1986) and therefore individuals would be expected to cover large areas. *Varanus mertensi* and *V. gouldii* are of approximately equal size (Cogger 1992), therefore individuals would be expected to cover similar areas. *Varanus scalaris* is the smallest varanid observed and is also arboreal (Cogger 1992), individuals therefore would be expected to cover small areas. From the number of sightings (Table 1) it appears that the frequency of observation reflects the areas occupied. *Varanus mertensi*, however limit their activity to riparian habitats (Cogger 1992, Christian *et al.* 1996) but their extended activity period may substitute for a limited area of occupation.

Although the route was driven only one time each in January, February and March (6 journeys in total), 18 of 55 (32.7%) of sightings were made in this period. *Varanus panoptes* and *V. mertensi* were seen most of the year. *Varanus gouldii* was rarely seen in the dry season. Exposure to abundant food all year round allows extended activity periods in tropical varanids (Christian *et al.* 1995, 1996). The creekbank habitats occupied by *V. mertensi* and the variety of habitats occupied by *V. panoptes* therefore may allow an extended activity period for these species.

Behavioural observations were made by passing the subject before stopping the vehicle and approaching. It is likely that the lizards were alert therefore the observed behaviour could not be inferred as natural escape behaviour. The alerted responses to approach differed among species. *Varanus panoptes* was most likely to run out of sight, while *V. gouldii* was likely to run into shrubs. *Varanus mertensi* ran into water and *V. scalaris* ran up trees. Most of the shrubs in the woodland are small and the large mass of *V. panoptes* would inhibit their use as retreats. *Varanus gouldii* were never seen in a riparian habitat, however one ran into a drain when it was full of water, rather than retreating to shrubs. It therefore appears to utilise the closest retreat. "Freezing" was used on two occasions by both *V. mertensi* (when its' path to the water was blocked) and *V. gouldii*. It appeared that escape to a retreat is the preferred strategy of all the varanids observed, with "freezing" and running out of sight adopted as secondary responses if a refuge cannot be found.

REFERENCES

Auffenburg, W. 1981. The Behavioural Ecology of the Komodo Monitor. University of Florida Press. Gainsville.

Blamires, S.J. 1999. Observations of a possible wild mating attempt for the water monitor *Varanus mertensi*. Herpetofauna 29: 55.

Blamires, S.J. and M. Nobbs. 1999. Observations of mangrove habitation by the monitor lizard *Varanus panoptes*. N.T Nat. 16: 21-23.

Braithwait, R.W. 1987. Effects of fire regimes on lizards in the wet-dry tropics of Australia. J. Trop. Ecol. 3: 265-275.

Christian, K.A., L.K. Corbett, B. Green and B.W. Weavers. 1995. Seasonal activities and energetics of two species of varanid lizard in tropical Australia. Oecologia 103: 349-357.

Christian, K.A., B.W. Weavers, B. Green and G.S. Bedford. 1996. Energetics and water flux in a semiaquatic lizard, *Varanus mertensi*. Copeia 1996(2): 354-362.

Cogger, H.G. 1992. Reptiles and Amphibians of Australia Fifth Edition. Reed Books, Sydney.

King, D.R., B. Green and H. Butler. 1989. The activity pattern, temperature regulation and diet of *Varanus giganteus* on Barrow Island, Western Australia. Aust. Wildl. Res. 16: 41-47

Shine, R. 1986. Diets and abundances of aquatic and semi aquatic reptiles in the alligator rivers region, Technical Memorandum 16. Australian Government, Canberra

Wilson, S.K. and D.G. Knowles. 1988. Australian Reptiles: A Photographic Reference to the Terrestrial Reptiles of Australia. Cornstalk, Sydney.

Woinarski, J.C.Z. 1993. The status of the herpetofauna and herpetology in the Northern Territory. Pages 81-106 in. D. Ayres and D. Lunney eds. Herpetology in Australia: a diverse discipline. Surrey Beatty and sons, Chipping Norton.

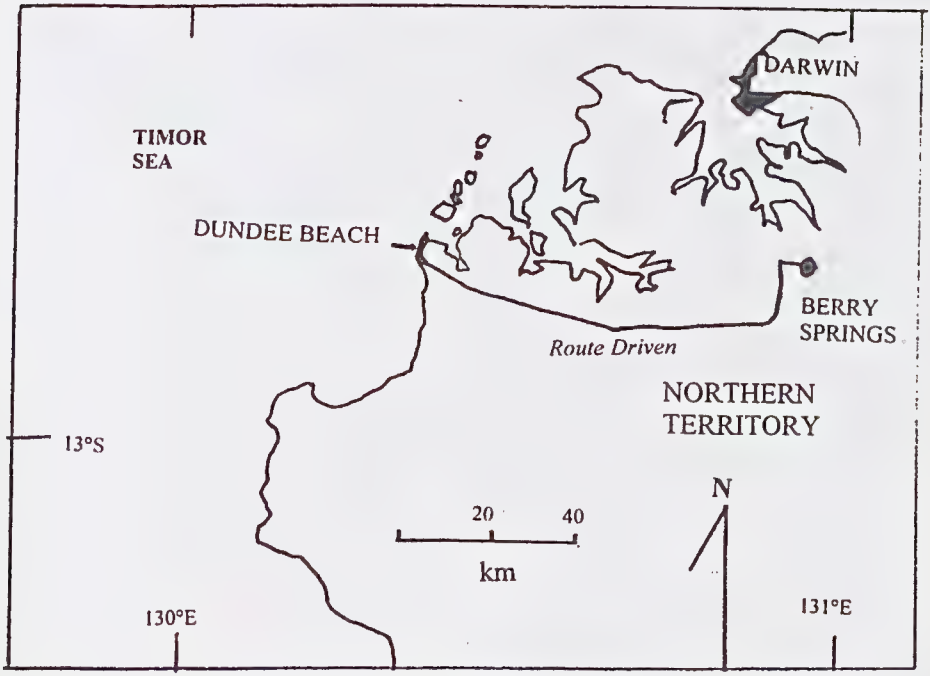
Table 1. Numbers of each species of varanid seen each month.

	J	F	M	A	M	J	J	A	S	O	N	D	Total
V. panoptes	2	3	1	1	3	0	1	3	3	4	3	2	26
V. gouldii	3	2	1	1	1	0	0	0	0	3	2	1	14
V. mertensi	1	1	2	2	0	0	1	1	0	1	2	1	12
V. scalaris	0	1	1	0	0	0	0	0	0	0	1	0	3

Table 2. Behaviour of each species of varanid, where 1 = "freezing", 2 = running into nearest grass/shrub, 3 = running up tree, 4 = running into water, 5 = running out of sight.

	1	2	3	4	5
V. panoptes	0	3	0	1	22
V. gouldii	2	8	3	1	0
V. mertensi	2	0	0	10	0
V. scalaris	0	0	3	0	0

Figure 1. The study area, which runs from Berry Springs, approximately 60km from Darwin, to Dundee Beach, the northern most stretch of beach along Fog Bay.



A MIXED COMMUNAL NEST OF SKINK EGGS

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A number of Australian skink species have been reported to nest communally, with several females laying eggs in the one site. In addition to the seven species listed by Greer (1989), communal nests have been described for *Carlia tetradactyla* (Porter & Husband, 1993) and *Lampropholis adonis* (Couper & Schneider, 1995), and an additional record for *Nannoscincus maccoyi* by Horrocks *et al* (1987), all small members of a single lineage of skinks, the *Eugongylus* group (Greer, 1979). As noted by Greer (1989), apart from a report of a single nest containing both *Lampropholis delicata* and *L. guichenoti* eggs (Wells, 1981), previously recorded communal nests generally contain the eggs of single species only. Shine (1983), citing Pengilley (1972), stated that mixed clutches are common. However, the latter author noted only a single mixed clutch, of *N. maccoyi* and *L. delicata*, from a restricted microhabitat, raising the possibility that the shared site might simply reflect lack of availability of suitable nesting sites.

On 24 January, 1999, the authors found two communal nests of skink eggs under rocks and grass tussocks on loose soil along road verges beside Youalls Trail, Werrikimbe National Park, between the junction with Racecourse Trail (31°06'26"S 152°14'13"E) and about 1km north. Both nests were in open eucalypt woodland with a bracken and grass understory, with large amounts of fallen and cut timber. The road verges bore many similarly situated rocks to those under which the nests were found. In each instance, the nest occupied a small area of interconnected earth cracks over an area of less than 20cm x 20cm surface, without any suggestion of a distinction between clusters of eggs in the nest. Both nests were transported in loose soil from the site in plastic takeaway food containers for several days before return to the laboratory, where they were held at room temperature in the same containers.

Eggs from the first nest hatched over an extended period between 22 February and mid-March. All 26 hatchlings during this period were *Lampropholis delicata* (Australian Museum [AM] R154421).

Eggs from the second nest also hatched over an extended period. Between 1 February and 22 February, 14 eggs hatched, 13 of which were *Saproscincus mustelinus* (AM R154419) and one of which was *Lampropholis delicata*. Over the next three weeks, a further ten eggs hatched, all *Lampropholis delicata* (AM R 154420).

There are two unusual features of these two nests. Firstly, the second nest contained eggs of two different genera, only the second record of this occurring, and the first instance where suitable nesting sites were plentiful.

Secondly, the extended period of hatching is not in agreement with previous data. Although no detailed notes were made of the precise dates of hatching, the eggs from the first nest hatched over a period of at least three weeks. Greer (1989) suggested that most communal nests of *Lampropholis* and *Saproscincus* species were deposited over a short period of time and consequently a short period of emergence ensued. Because previous records involved only single species, even in areas of sympatry between two or more species known to nest communally (Clarke, 1965), he further suggested that the cues drawing females to the nest were probably species-specific.

The mixed nest reported herein involved

asynchronous hatching of the two species. Whether this involved asynchronous laying is not known, as no details are available of relative incubation times in the two species under the same conditions (although Shine, 1983, reports incubation times for high altitude *L. delicata* at four temperatures). However, the lengthy period of hatching of the first (single-species) nest, despite uniform incubation conditions, suggests that eggs were laid over an extended period in this instance at least.

One consequence of the mixed nest reported herein is that future studies of communal nests should consider the entire nest, rather than a sample of eggs, and await hatching of all eggs, rather than just the first few to hatch, to determine the content.

ACKNOWLEDGEMENTS

Eggs were collected under NPWS Permit A1397.

REFERENCES

Clarke, C.J. 1965. A comparison between some Australian five-fingered lizards of the genus *Leiolopisma* Dumeril & Bibron (Lacertilia:Scincidae). Australian Journal of Zoology 13(3): 577-592.

Couper, P.J. & Schneider, C.J. 1995. Communal nesting in the small skink, *Lampropholis adonis*. Memoirs of the Queensland Museum 38(2): 382.

Greer, A.E. 1979. A phylogenetic subdivision of Australian skinks. Records of the Australian Museum 32(8): 339-371.

Greer, A.E. 1989. The biology and evolution of Australian lizards. Surrey Beatty & Sons, Chipping Norton.

Horrocks, G.F.B., Brown, G.W., Carr, G.W., Cherry, K.A., Craig, S.A., Opie, A.M. & Triggs, B.E. 1987. Flora and fauna of the Beleko and Gibbo River Forest Blocks, Alpine Area, Victoria. Dept of Conservation, Forests & Lands, Victoria, Ecological Survey Report (10): 1-90.

Pengilley, R. 1972. Systematic relationships and ecology of some lygosomine lizards from southeastern Australia. Ph.D. thesis, Australian National University.

Porter, R. & Husband, G. 1993. A record of communal egg-laying in the skink *Carlia tetradactyla*. Memoirs of the Queensland Museum 33(1): 60.

Shine, R. 1983. Reptilian viviparity in cold climates: testing the assumptions of an evolutionary hypothesis. Oecologia, 57: 397-405.

Wells, R. 1981. Utilization of the same site for communal egg-laying by *Lampropholis delicata* and *L. guichenoti*. Australian Journal of Herpetology 1(1): 35-36.

CONFIRMATION OF OCCURRENCE OF THE SKINK *EGERNIA MARGARETAE* IN WESTERN NEW SOUTH WALES.

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Three *Egernia* species, *E. striolata*, *E. inornata* and *E. stokesii* are currently known from western New South Wales. in this note we confirm the occurrence of a fourth member of the genus, *E. margaretae* (Figure 1).

As the result of a photograph taken of a skink at Mutawintji National Park in 1993, which was tentatively identified as *E. margaretae* (Foster, 1993), joint surveys were undertaken by the Australian Herpetological Society and the South Australian Herpetology Group from 1994 to 1996.

During these surveys seven individuals of *E. margaretae* were recorded. As these sightings occurred over several years it is possible that an individual may have been recorded more than once. All of the individuals were observed within Homestead Gorge or its small side gorges. Two specimens have been lodged with the Australian Museum. Both were found in Homestead Gorge (31'19'S 142'18'E). AMR146257 was collected on 25 October 1994 at approximately 9.00am EST while basking in front of a burrow beneath a large rock slab. AMR147150 was collected on 13 April 1995 sheltering in a rock crevice.

All individuals were associated with large boulders or stone slabs, usually with soil at the base in which there were burrows. This resembles their habitat in South Australia (Foster, pers. obs.), as described by Ehmann (1992) and Wilson & Knowles (1988). At Mutawintji this species is far more wary than *E. striolata* with which it shares the rocky gorge habitat. *E. margaretae* would invariably remain close to cover often in shadow and move into this cover quickly when disturbed. *E. striolata* was far more visible and less inclined to move into cover.

The two specimens were initially identified as *E. margaretae* on the basis of colour and patterning. They were keyed out to *E. margaretae* by the conspicuous black callus along the free edge of the subdigital lamellae, and the prominent black tubercules on the scales of the soles and palms, which separates them from *E. multiscutata*, *E. whitii* and *E. modesta* (Cogger 1996).

E. margaretae has a disjunct distribution, occurring in the Flinders ranges of South Australia, the ranges of northern SA and southern Northern Territory as well as NSW. In New South Wales it is currently only known from one gorge within Mutawintji National Park where it appears to be uncommon. It is now listed under Schedule 1 of the NSW Threatened Species Conservation Act as an endangered species. A Recovery Plan has been released with the objectives of locating populations in NSW, determining the genetic significance of the NSW populations, monitoring the known populations in Mutawintji National Park and identifying current or potential threats to known populations.

ACKNOWLEDGMENTS

Thanks to the many members of the AHS and SAHG who took part in the survey work during 1994, 1995 and 1996. Also to Sharon Davey, Rob McKinnon, and Matt Le Duc at Mutawintji for their assistance during our visits.

REFERENCES

Cogger, H. G. 1996. Reptiles & Amphibians of Australia. Reed Books Australia, Melbourne.

Ehmann, H. 1992. Encyclopedia of Australian Animals, Reptiles. Angus & Robertson, Sydney.

Foster, R. 1993. A significant range extension of *Egernia margaretae personata*? Herpetofauna: 23(2):35-36.

Wilson, S.K. & D.G. Knowles 1988. Australia's Reptiles: A Photographic Reference to the Terrestrial Reptiles of Australia. Collins, Sydney.

Figure 1. *Egernia margaretae* (R146257) from Mutawintji National Park.

Figure 2. Distribution of *Egernia margaretae*.

HERPETOLOGICAL NOTES

RECORDS OF THE WESTERN BROWN SNAKE *PSEUDONAJA NUCHALIS* (SERPENTES: ELAPIDAE) FROM TOWNSVILLE, NORTH EAST QUEENSLAND

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Pseudonaja nuchalis occurs over much of the Australian continent with the exception of cool and/or mesic zones in the south and east (Cogger, 1995). Coastal habitats are occupied throughout Western Australia (with the exception of the far south coast), the Northern Territory and Cape York Peninsula (Gow, 1977, Longmore, 1989, Covacevich & Couper, 1994).

On the east coast of Australia (between the Cooktown area in north Queensland and Victoria) *P. nuchalis* is only recorded near coastally in the Rockhampton district (Longmore, 1989, Covacevich & Couper, 1994). Covacevich (1989), observes that there are several relatively low rainfall belts on the east coast in the vicinity of Cooktown, Townsville and Rockhampton/Gladstone, accounting for the occurrence of 'dry country' reptiles in these areas. It is surprising that *P. nuchalis* has never been recognised in the literature as occurring in Townsville and that no specimens are lodged with the Queensland Museum (Longmore, 1989, Covacevich & Couper, 1994, Covacevich, pers. comm).

On the 14th October 1999 the authors examined an adult male *P. nuchalis* removed from a residential property at Kelso, Ross River Road, Townsville (Fig.1). Sullivan (pers. comm.) has examined two *P. nuchalis* captured in urban Townsville and Calvert (pers. comm.) has captured specimens at Nome on Townsville's southern outskirts and at Woodstock, 30km west of Townsville. *Pseudonaja nuchalis* is well known from Charters Towers, 120 km. west of Townsville (Longmore, 1989, Covacevich & Couper, 1994).

ACKNOWLEDGEMENTS

Our sincere thanks to Scott Sullivan of the Environment Protection Agency, Pallerenda, Townsville for allowing access to the Kelso specimen. Thanks also to Greg Calvert of James Cook University and Jeanette Covacevich of the Queensland Museum for providing field records and distribution data.

REFERENCES

Cogger, H. G. 1995. Reptiles and amphibians of Australia. Fifth edition with amendments. Reed Books. Sydney.

Covacevich, J. A. 1989. Aspects of the biogeography of the elapid snakes of north eastern Australia. pp. 20-24 in R. Longmore (ed). Snakes: atlas of elapid snakes of Australia. Bureau of Flora and Fauna. Canberra.

Covacevich, J. A. & Couper, P. J. 1994. The reptile records. pp. 45-140 in G. J. Ingram & R. J. Raven (eds). An atlas of Queenslands frogs, reptiles, birds and mammals. Queensland Museum. Brisbane.

Gow, G. F. 1977. Snakes of the Darwin area. Museums and Art Galleries Board of the Northern Territory.

Longmore, R. (ed.) 1989. Snakes: atlas of elapid snakes of Australia. Bureau of Flora and Fauna. Canberra.

Figure 1: *Pseudonaja nuchalis* from Townsville, QLD.

OBSERVATION OF A BLACK SNAKE SWALLOWING PREY.

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On 15 October 1999 around midday, while bird watching near Meroo Lake on the South Coast of NSW (35°28.8'S, 150°16.6'E), I saw a 1.5m Red-bellied Black snake (*Pseudechis porphyriacus*) about 6 metres away. I was able to watch the snake for thirty-five minutes, during which time it swallowed two "lizards" about 30cm long. I was using 7x35 binoculars.

When first seen, the snake's head was not in view, being behind a slight rise in the terrain and probably in the entrance of a hole in the ground that sloped downwards and away from me. As I watched, the snake moved back - a movement I do not remember seeing before. (I had often jokingly asked colleagues if snakes were fitted with reverse gear - now I know! Its tail tip was flicked during this backward movement, as if feeling its way). When the head appeared, the snake was holding a lizard about 30cm long, with a lace-like pattern. From later enquiries at the Australian Museum, it seems likely this was a young Lace Monitor (*Varanus varius*), perhaps only recently hatched.

The snake proceeded to swallow the lizard. There was some manipulation, and I am not sure if this first lizard was swallowed headfirst or tail first. (I am sure the second one was swallowed tail first). I was very interested in the method of swallowing. I had been expecting the lower and upper jaws to be moved forward alternately over the prey, as I had seen once in a TV documentary, but the observations did not fit this. Instead, the snake's head was moved rapidly from side to side, with a pause of a few seconds after each movement. Though I could not see the detail, this method of swallowing matches he following description (Ernst and Zug1996:27): "As the jaws on one side of the head begin to open, those on the other side bite down. The opened jaws then shift forward, disengaging their teeth from the prey and biting it anew. As one side bites, the other shifts forward. Thus the left and right sides ratchet over the prey, forcing it rearwards into the esophagus."

Shortly after swallowing the lizard, the snake moved forward and then backward - with a second lizard in the mouth.

There were no signs of life in either lizard. The quick side-to-side movements of the snake's head caused the lizard's body to bend, showing that it was not stiff.

At some time in the manipulation before swallowing I saw part of the lizard's body that had been in the mouth covered with a brownish liquid.

After swallowing the second lizard, the snake moved forward and disappeared completely into the hole in the ground.

I visited the site again on 24 November 1999, planning to photograph the hole. I was surprised to find the entrance to the hole covered in with black soil, leaving only a depression about 20-30cm diameter and 10-15cm deep. Scratching the soil at the former entrance to the hole revealed active termites. There had been over 200mm of rain in the area between the visits.

A few days later on 1 December, I was passing the site and noticed that the sloping hole was again clear. I could look in some 30-40cm. Soil had been deposited in front of the entrance. It is very unlikely that this opening was done by a human. The deposited soil extended 30-50cm outwards from the mouth of the hole, suggesting perhaps that the female monitor had returned to the site and reopened the nest to free any hatchlings inside (Boylan, 1995). If hatchlings had dug themselves out I would have expected a different pattern, with broken soil deposited only near the hole entrance.

ACKNOWLEDGMENT

The help of Search & Discover at the Australian Museum is gratefully acknowledged.

REFERENCES

Boylan, T. 1995. Field observations, captive breeding and growth rates of the Lace Monitor, *Varanus Varius*. Herpetofauna 25 (1): 10-13.

Ernst, C. H. and Zug, G. R. 1996. Snakes in Question. CSIRO Melbourne.

NOCTURNAL ACTIVITY BY GOULD'S MONITOR *(VARANUS GOULDII)* AT TOWN COMMON ENVIRONMENTAL PARK, TOWNSVILLE QLD

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INTRODUCTION

Australian varanids are generally considered diurnal animals with documented nocturnal activity in the wild poorly represented in the literature (Greer 1989). Most varanid nocturnal activity in the literature involves captive specimens, particularly in the act of egg deposition. Nocturnal egg deposition in captivity by Australian varanids has been reported for *Varanus giganteus, V. indicus, V. keithhornei,* and *V. mertensi* (Irwin 1996). Jones (1998) reported a nocturnal captive observation of *V. varius* moving around its enclosure and then finally resting on a log. He also reported captive *V. acanthurus* digging in their enclosures at night. Observations of nocturnal foraging activity in the wild by varanids are far more scarce. Christian (1977) reported *V. glebopalma* foraging for lizards and insects in the first couple of hours of darkness. Fyfe (1979, 1980) reported nocturnal feeding by *V. tristis* at lights outside of a building. Valentic (1995) reported a *V. spenceri* active after rains on a road at night. Irwin (1996) reported wild *V. panoptes* foraging for food at night.

OBSERVATIONS

On the 14th of November 1998 at 2040 hours, which was 1 hour after dark (air temperature 24°C) an adult *V. gouldii* (445mm snout vent length (total length 1090mm), weight 1300g, sex indeterminate) was observed in vehicle headlights foraging on the edge of a gravel road lying between an area of low-lying, seasonally flooded grassland and a salt flat at the Town Common Environment Park, Townsville.

The *V. gouldii* was actively attempting to capture an unidentified frog when initially sighted. The lizard did not appear to be distressed in the car headlights and was observed to rear up and lunge at a large moth drawn to the lights.

DISCUSSION

Nocturnal activity in Australian varanids may be more common than literature records suggest. The observed individual was extremely active and was clearly taking advantage of considerable prey species activity. Frogs, insects, and Keelback snakes *Tropidonophis mairii* were all active on the road where the observations took place. Large tropical monitors such as *V. gouldii* can probably forage after dark as their large body size may impart considerable thermal inertia. In addition a bifurcate tongue and Jacobsons organ may allow effective prey detection, and capture in total darkness (Bennett 1998). Auffenberg (1981) suggests that Komodo dragons *V. komodoensis* are capable of active foraging using visual as well as olfactory cues on moonlit nights. Similar behaviour would be expected for tropical Australian monitors.

ACKNOWLEDGMENTS

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REFERENCES

Auffenberg, W. 1981. The Behavioral Ecology of the Komodo Monitor. University Presses of Florida. Gainesville, Florida. 406pp.

Bennett, D. 1998. Monitor Lizards: Natural history, biology & husbandry.

Christian, T. 1977. Notes on *Varanus glebopalma*. Victorian Herpetological Society Newsletter. 6 (2):11-13

Fyfe, G. 1979. Spotlighting for Reptiles. Victorian Herpetological Society Newsletter. 14: 19

Fyfe, G. 1980. Notes on the black-headed monitor *(Varanus tristis)*. Herpetofauna 12 (1): 15

Greer, A.E. 1989. Biology and Evolution of Australian Lizards. Surrey, Beatty and Sons, N.S.W. 264pp.

Irwin, S. 1996. Nocturnal Nesting By Captive Varanid Lizards. Herpetological Review 27 (4): 192-193

Irwin, S. 1996. Nocturnal Activity by *Varanus panoptes* At Cape Melville. Herpetofauna 26 (2): 50

Jones, A. 1998. Nocturnal Activity In Captive Varanid Lizards. Herpetofauna. 28 (2): 50-51

Valentic, R.A. 1995. Further Instances Of Nocturnal Activity In Agamids And Varanids. Herpetofauna. 25 (1): 49-50

CLUTCH SIZE FOR STIMSONS' PYTHON *(ANTARESIA STIMSONI).*

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INTRODUCTION

A large female *Antaresia stimsoni* was maintained in an outside cage at the Northern Territory University subject to ambient shaded conditions. Water was given on one day per week.

On 31 October 1997, the python laid 14 eggs, each of which appeared in good condition. The clutch mass was 160 grams with the postparturition female mass being 290.0g, giving a relative clutch mass of 55%. The snout-vent length of the female snake was 103.4cm and the tail length was 11.4cm. The eggs were removed from the female and seven were measured with a mean egg size of 34.6mm x 24.6mm (Table 1). They were placed in a plastic container on a substrate of 50% perlite and 50% vermiculite with the perlite as the lower half. This was hydrated with 95% the mass of the substrate using distilled water. The egg container was placed in a constant temperature cabinet (SEM and Fisher and Paykel) at 32°C. No further water was added to the mixture and the lid to the container was tight fitting with small holes for oxygen transfer within the cabinet. Young began hatching on 16 December and finished on 18 December. This is an incubation time of 46 days which is a short incubation period even for a member of the *A. childreni* complex (Ross and Marzec 1990). The mean size of hatchlings was 253.5mm SVL and 6.9grams (Table2)

ACKNOWLEDGMENT

Thank you to the reviewer.

REFERENCE

Barker, D. G. and Barker, T. M. 1994. Pythons of the World: Vol. 1, Australia. Advanced Vivarium Systems, California, USA.

Ross, R. A. and Marzec, G. 1990. The Reproductive Husbandry of Pythons and Boas. The Institute for Herpetological Research Stanford, California.

Table 1. *A. stimsoni* egg measurements.

Number	egg length (mm)	egg width (mm)
1	33.7	24.0
2	38.3	24.7
3	32.2	25.0
4	29.5	24.8
5	33.3	24.5
6	35.3	25.2
7	39.8	24.0
mean	34.6	24.6

Table 2. Hatchling *A. stimsoni* measurements. The numbers of hatchlings do not directly correspond with egg numbers as hatching from numbered eggs was not monitored.

Hatchling Number	Snout-Vent Length(mm)	Mass (grams)
1	238.0	7.0
2	243.0	7.0
3	248.0	6.6
4	255.0	6.9
5	262.0	7.6
6	262.0	6.7
7	252.0	7.0
8	257.0	6.6
9	247.0	6.5
10	255.0	6.8
11	252.0	6.7
12	260.0	7.0
13	258.0	6.8
14	260.0	6.9
Mean	253.5	6.9

RECORD OF AN EXTREME LEUCISTIC *RHINOPLOCEPHALUS NIGRESCENS* (SERPENTES: ELAPIDAE)

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Leucistic and albino specimens have been recorded in a number of Australian snake genera, but to date, only within the Pythonidae and Elapidae (Greer, 1997).

Australian pythons displaying partial albino characteristics are well known, eg. *Aspidites melanocephalus* (Shine, 1991). Barker and Barker (1994) illustrate an albino *Morelia spilota* which still displays a distinct dorsal pattern, but only two complete (translucent white) albinos have been recorded: a specimen of *Liasis olivaceus* (Bedford, 1993) and a Townsville *Antaresia maculosus* (Sullivan, pers. comm.).

Among the Elapidae, partial albinos have been recorded for *Rhinoplocephalus pallidiceps* (Shea & Kent, 1988., Gow, 1989) and *R. nigrescens* (pers. obs.) Albinos are recorded for *Cacophis harriettae* (Furbank & Nelson, 1994), *C. squamalosus* (Shea & Kent, 1988), *Hemiaspis signata* (Shine, 1991), *Hoplocephalus bitorquatus* (Shea & Kent, 1988., Gow, 1989), *Pseudechis porphyriacus* (Greer, 1997) and *Demansia psammophis* (pers. obs.). Furbank and Nelson (1994) record albinism in an unspecified species of *Pseudonaja* from a personal communication with J. Covacevich. Mirtschin and Davis (1991) illustrate a leucistic *Notechis scutatus*.

On the 10th of July, 1999 the author examined a leucistic *Rhinoplocephalus nigrescens* from Mackay, north east Queensland. This adult specimen was predominantly pinkish white with a pure white dorsal vertebral stripe, resulting from vertebral sinew being visible through the translucent skin. Eye colour was typical for the species (dark brown to black) as were some isolated dorsal scales on the fore body and tail.

Scale counts narrowed the identification of this specimen to either *R. nigrescens* or *R. boschmai*, with positive identification resting on head scalation. In *R. boschmai* there is separation of the preocular and nasal scales by the prefrontal scale which curves down to meet the labial scales. No such separation occurs in *R. nigrescens* (Cogger, 1995).

ACKNOWLEDGEMENTS

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REFERENCES

Barker, D. G. & Barker, T. M. 1994. Pythons of the world: volume 1, Australia. Advanced Vivariurn Systems Inc. Lakeside, California.

Bedford, G. 1993. Eye protection during basking by an albino olive python (*Liasis olivaceus*). Herpetofauna 23(2). pp. 39- 40.

Cogger, H. G. 1995. Reptiles and amphibians of Australia. Fifth edition with amendments. Reed Books, Sydney.

Furbank, M. & Nelson, S. 1994. Reproduction notes and the first record of albinism in the white crowned snake *Cacophis harriettae* (Serpentes: Elapidae). Herpetofauna 24(2). pp. 31- 32.

Gow, G. 1989. Graeme Gows complete guide to Australian snakes. Angus & Robertson. North Ryde, Sydney.

Greer, A. E. 1997. The biology and evolution of Australian snakes. Surrey Beatty & Sons. Chipping Norton, NSW.

Mirtschin, P. J. & Davis, R. 1991. Dangerous snakes of Australia: an illustrated guide to Australia's most venomous snakes. Rigby. Adelaide. Revised edition.

Shea, G. M. & Kent, D. S. 1988. Albinism in bluetongue lizards (Scincidae: *Tiliqua*). Herpetofauna 18(2). pp. 3-4.

Shine, R. 1991. Australian snakes: a natural history. Reed Books, Sydney.

BOOK REVIEW

HERPETOLOGICAL BIBLIOGRAPHY OF INDONESIA

By Indraneil Das

Published by Krieger Publishing Company, PO Box 9542
MELBOURNE, FL 32902,USA
(1998) 96pp US $22.50
ISBN 1-57524-026-2 (Hardcover)

The title of this volume led me, perhaps unjustifiably, to expect a little more when I opened the book. I had anticipated a referencing and cross-referencing system enabling me to be able to look up particular species or topics. I was therefore disappointed to find that the work was no more than it purported to be: a list of publications in alphabetical and chronological sequence. I was also particularly disappointed to discover that without explanation, New Guinea and associated islands have been excluded, despite the fact that they are a part of the Republic of Indonesia.

The perception of what constitutes Indonesia (and therefore which papers are included in this bibliography), is significant. The Coco Islands 200km southwest of mainland Myanmah, and the Andaman and the Nicobar Islands between the Cocos and Sumatra are controlled by Indonesia: an overall chain of islands extending 1000km north of Sumatra. All of these islands are included in the bibliography as are Sarawak, Sabah and Palowan and associated islands of the Philippines. It follows that the geographic ambit of this work is confusing to any herpetologist who perceives "Indonesia" to be the geographic area currently within its recognized boundaries.

From visits to 12 libraries Dr Das assembled approximately 1500 references in 14 languages. The only criterion for inclusion was the reference to an amphibian or reptile, so in addition to scientific papers there are magazine and newspaper articles, books and chapters, book reviews, field reports, catalogues, bibliographies and theses.

Anyone interested in bibliography, either from the viewpoint of particular taxa or biogeographic area, will need to consult this work simply to check the completeness of their own literature searches, or as a starting point.

Dr Das has performed a service to the herpetological community by assembling this volume and Mr Krieger a service by making it readily available in an attractive bound form.

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NOTES TO CONTRIBUTORS

Herpetofauna publishes articles on any aspect of reptiles and amphibians. Articles are invited from interested authors particularly non-professional herpetologists and keepers. Priority is given to articles reporting field work, observations in the field and captive husbandry and breeding.

All material must be original and must not have been published elsewhere.

PUBLICATION POLICY

Authors are responsible for the accuracy of the information presented in any submitted article. Current taxonomic combinations should be used unless the article is itself of a taxonomic nature proposing new combinations or describing new species.

Original illustrations will be returned to the author, if requested, after publication.

SUBMISSION OF MANUSCRIPT

Two copies of the article (including any illustrations) should be submitted. Typewrite or handwrite (neatly) your manuscript in double spacing with a 25mm free margin all round on A4 size paper. Number the pages. Number the illustrations as Figure 1 etc., Table 1 etc., or Map 1 etc., and include a caption with each one. Either underline or italicise scientific names. Use each scientific name in full the first time, (eg *Delma australis*), subsequently it can be shortened (*D. australis*). Include a common name for each species.

The metric system should be used for measurements.

Place the authors name and address under the title.

Latitude and longitude of any localities mentioned should be indicated.

Use the Concise Oxford Dictionary for spelling checks.

Photographs – black and white prints or colour slides are acceptable.

Use a recent issue of Herpetofauna as a style guide.

A computer disc may be submitted instead of hard copy but this should not be done until after the manuscript has been reviewed and the referees' comments incorporated. Computer discs must be HD 1.44 mb 3.5" in Word for Windows; Wordperfect; Macintosh or ASCII. Any disc must also be accompanied by hard copy.

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REFERENCES

Any references made to other published material must be cited in the text, giving the author, year of publication and the page numbers if necessary. At the end of the article a full reference list should be given in alphabetical order. (See this journal).

Manuscripts will be reviewed by up to three referees and acceptance will be decided by an editorial committee. Minor changes suggested by the referees will be incorporated into the article and proofs sent to the senior author for approval.

Significant changes will require the article to be revised and a fresh manuscript submitted.

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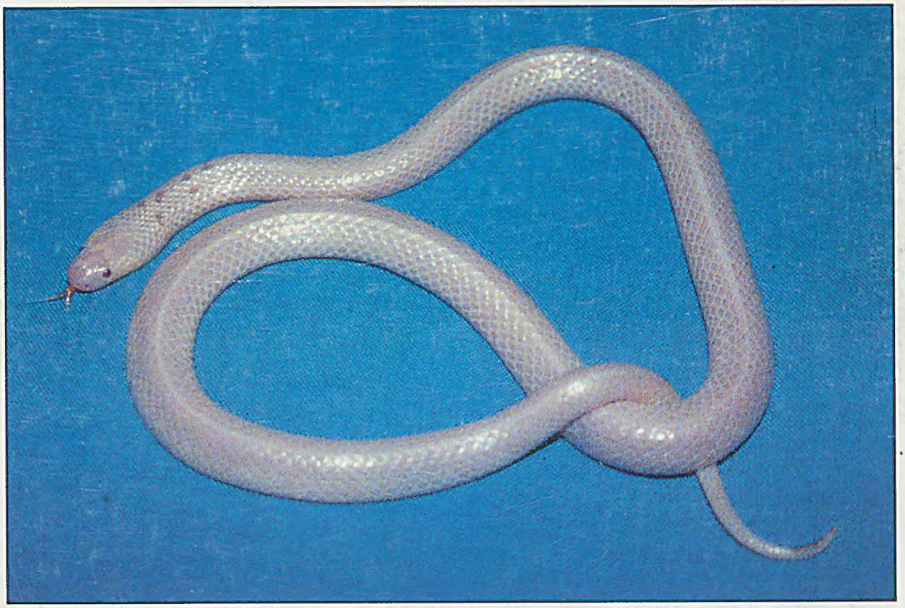
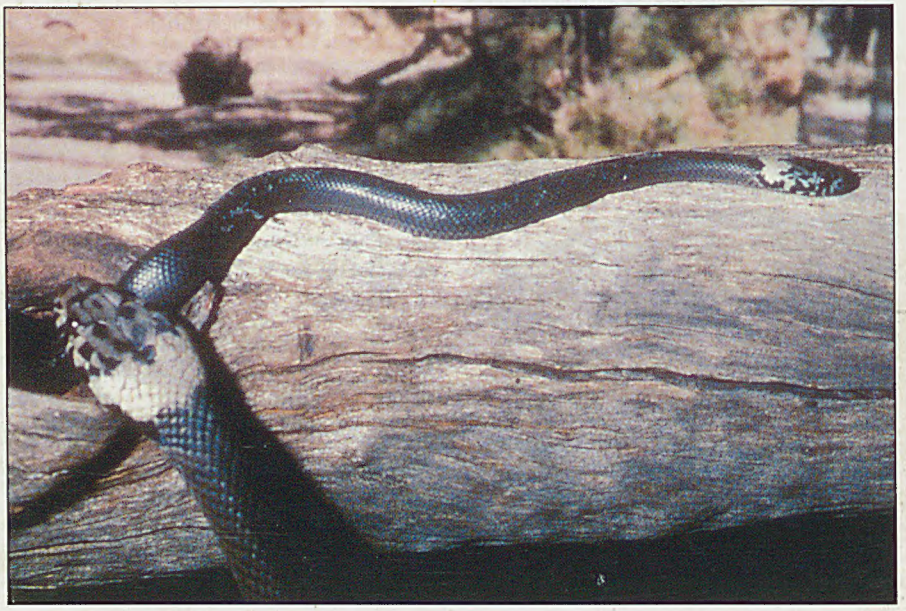


Leucistic *Rhinoplocephalus nigrescens*. See paper on page 55.



Pale-headed snake, *Hoplocephalus bitorquatus* with neonate. See paper on page 18.